JOURNAL OF GAS LIGHTING & WATER SUPPLY.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CXXIII., No. 2627.] TUESDAY, SEPTEMBER 16, 1913. [65TH YEAR.

EDITORIAL NOTES.

Exhibition and Conference Plans.

CROWNED by the highest possible patronage, the National Gas Exhibition will be opened in fifteen days from now; and the workers in the cause of it, with Sir Corbet Woodall, the President of the Exhibition, at their head (although not bearing the burden of the detail work), will see the scheme which they visioned and planned, and have unselfishly slaved for, fully materialized. There has been a notable display of earnestness on the part of those who have borne the weight of the greater part of the work; and it would ill-become us here not to name (his co-workers would wish us to do it) Mr. F. W. Goodenough as the mainspring of their activities and plans, and the ardent unsparing worker in their fulfilment. Everything is being done with a thoroughness that makes it difficult to put a finger upon any matter within the bounds of the scheme, so far as we know these bounds, and say that therein is a defect. If defects there ultimately be, they will only be the unavoidable ones imposed on the organizers by the limitations of inflexible circumstances, and not inherent to their plans within the scope of their liberty and power to make them perfect.

To bring about the ultimate success—the attraction of the public, and the placing of knowledge where it will be of especial use to the gas industry—the organizers have laid their plans deep and wide; and it will now rest largely upon the managements of gas undertakings in working further for this success, through the means offered them, by using local influence that the organizers cannot possibly possess. To the exhibition and the conferences, the managements of gas undertakings should get those interested in local government, education, medical work, architectural work, industry, and so forth; to the exhibition and the popular lectures, the managements of gas undertakings should get as many members as possible of their local public. Samples of the literature prepared for this purpose will already be in the hands of subscribers; and these will have convinced them that they need not hesitate in working vigorously to get to London and to the exhibition and conferences as many as may be of the community of their areas, with representatives of the professions and of local government, in both honorary and official capacity. There will be much worth seeing; there will be distinguished men worth hearing; there will be opportunity for free discussion, from which will flow increased knowledge, which will result in the wiping-out of mistakes and of the abuse of common sense, and also in the setting-up of truth.

With regard to the exhibition itself, it will have a superficial area about four times that of Olympia. In 1904, at the Earl's Court Gas Exhibition, the throng of people on Saturday nights had to be police controlled on account of the narrowness of the gangways. In the plans for the present Co-Operative Exhibition, this has been remembered; and the gangways will be broad, so as to allow on the busy evenings the free circulation of the visitors. There need not be any crowded gangways or exits, unless the people turn up at the exhibition in unprecedented masses. We cannot yet tell what will happen; but we are hoping that sanguine expectations will be exceeded. The exhibition will be unique in its demonstrating character, and in the absence of rival firms' stands, of which the public has become tired. It is many-sided in its popular features. Apart from the silent and convincing demonstration of lighting, heating, and hot-water supply in suitable settings, attractive will be the activity not only in the conferences and lectures, but in showing how to cook, and how gas is used in certain industrial work—such as printing, laundry operations, &c.—and how the owners of large establishments can employ gas-engine plant for the generation of electricity for lighting and power (if they prefer electrical energy) at a cheaper rate than that for which it can be furnished to them from other sources. There will also be moving pictures illustrating applications of gas. There will be something doing all the time; and there will be few vacant time spaces during the days of the display. The programmes of the conferences for all-comers (not gas men more than others) and public lectures sufficiently show this; and these do not include the programmes of cookery and other demonstrations and competitions, nor the other guiding literature that is in preparation for ensuring that the stranger in the halls at Shepherd's Bush during October shall know what to see, and how best to see it.

The programmes for the conferences and lectures, of which we publish the main portions in other columns for the information of the gas industry generally apart from the subscribers (who have already received copies), must be taken as provisional, and subject to correction during the next few days. The members of learned and technical bodies will receive copies of these programmes with invitations to attend the conferences. Those who accept will find themselves in good company. The authors of the papers to be read at the conferences are all men of position as scientists or specialists; and their names ensure that what will appear in their communications will be the result of scientific research and investigation, or else of practical experience. The conference is to be divided into eight sections, meeting on nine different days. The sections will be devoted to: (1) Food and Cookery; (2) Coal Smoke Abatement; (3) Educational Topics; (4) Hygiene of Lighting and Heating; (5) Science of Illumination; (6) Economics of the Home; (7) Conference of Employers; and (8) Conference of Manufacturers. There is a good breadth about this conference scheme. The popular lectures are also on the same plane of completeness; and they will be spread practically over the whole of the days of the exhibition. From conference and lectures, there will issue a large amount of matter for propaganda literature and for other use.

It is the duty of every gas undertaking to do its part in making known the exhibition—by posters, by the prepared literature, by special invitations, and by the issue of admission tickets. Now is the time to set to work.

Are Trades Unionism and Co-Partnership Incompatible?

THE answer is "No," when trades unionism is limited to legitimate method, and does not connive at unlawful and unreasonable acts. The question stands at the head of the paper that Mr. Charles Carpenter, D.Sc., read before Section F at the meeting of the British Association last week; and Mr. Carpenter, from his long experience and study of co-partnership and trades unionism, was able to show that they are not incompatible within the legitimate sphere of the latter. The reservation expressed by the foregoing is ours; and, if it be accepted, then Mr. Carpenter did something more than demonstrate that trades unionism and co-partnership are not incompatible. He submitted an incontestable case which shows conclusively that, while fundamental principles and objects are alike, conflict really only arises in the methods of attaining the objects, with co-partnership pre-eminent in that it presents more material results for the men, individually and collectively, than any trade union system *per se*. As a matter of fact, the modern trade unions show that their policy in striving for their objects has failed in that it has not secured the objects as quickly as they have been attained, with yearly increment, by those men who, be they unionists or non-unionists, are harvesting the benefits of co-partnership.

At every point, those who attempt destructive criticism of co-partnership find that their case is wrecked on the rock

of experience—an experience extending over a quarter of a century in the case of the South Metropolitan Gas Company, since Sir George Livesey launched the scheme. In that Company, as well as in other co-partnership gas companies, no discrimination is ever made between unionist and non-unionist; and, taking the objects of typical unions one by one, Mr. Carpenter proves his case as to compatibility on every point, and supports his appeal for unionism and co-partnership running side by side. Under co-partnership, union hours and rates of wages are alike. Co-partnership does not aim at taking from standard pay, but adding to it by additional reward. In the case of the London and many other gas companies, the employers have voluntarily increased the wages of their men. A greater share is also sought for the workers, through trades unionism, in the profits resulting from the joint efforts of capital, brains, and labour; and co-partnership answers the claim and fulfils the object. The men have ample protection under their co-partnership agreements, which assure them, so long as their conduct is upright, a safe tenure of employment during the term of the contract. This, again, is an object of trades unionism. The contracts can be as easily cancelled by mutual consent under co-partnership as under service without it. The men under co-partnership gain all the beneficial funds and privileges, and more (experience declares by obvious and tangible evidence) than the best employment under trades unionism, *minus* co-partnership, can ever show. Why is this? We believe that the answer is found in that, through the agency of co-partnership, employers are brought into more intimate contact with their men, and a greater personal interest in the latter is thereby engendered and established. Where, then—taking the objects of trades' unionism alone—is there anything in co-partnership that is repugnant to the fundamental principles and objects of trades unionism? Mr. Carpenter could not see anything; nor can we. But no one can deny that one of the influences of co-partnership is to divorce men not from principles and from objects, but from methods whereby modern trades unionism seeks to attain objects that are the more prompt result of co-partnership.

The discussion on the paper was at once disappointing and satisfactory—disappointing, because no one ventured upon a negation of the case submitted by the author showing that the interests of trades unionism and co-partnership are compatible; and satisfactory, because it may be taken that, as it was not done, it was impossible to do it. There was much said about the agreements under co-partnership, and of the limitation of the freedom of the men. The author truly said that "no agreement of service would keep an "organized body of men from striking if they were earnestly "of opinion that their conditions of employment were unfair "or unjust." There is no question about that. Whether earnestly of opinion or not that the conditions of their labour are unfair, there have been several instances of the members of trades unions breaking from their agreements, and so putting the country to much inconvenience, loss, and distress. Agreements seem to want something more at their backs to assure that they are not violated; and this something is not only self-interest, but the self-esteem which respects honesty. We maintain, from the experience, that it is not the direct benefits of co-partnership alone that have, generally speaking, effected among co-partners an honest observance of their agreements, but it is the effect upon the men themselves in improving their self-respect, and implanting and cultivating within them a higher standard of duty and obligation. The lessened number of accidents, too, to which Mr. Carpenter was able to call attention in the case of the South Metropolitan Company's co-partners, indicates an improvement in the character of the men as a body. Indeed, the drift of the influence of co-partnership is altogether away from the stubborn influences of modern trades unionism, with the members shepherded and directed by the few, and the individual robbed of the right to think for himself by the forces with which he is surrounded. It is due to this that trades unionists are often found collectively adverse to co-partnership, not because they individually believe it is not good, but because they are governed in the matter by their leaders. And the reason why the leaders are averse to co-partnership is because its fruits set the individual thinking, he is satisfied, and he becomes ultimately divorced from the unionism that uses the strike as a weapon, and refuses the more peaceful, profitable, and expeditious course to the common object of raising the status of the men in relation to reward and conditions of work. Co-partnership, in short, is a sharpener of intelligence that does not suit the methods of militant trades unionism.

Closely associated with this point is one raised in the discussion by Mr. George Cadbury, who remarked: "The "workman would now think twice before in any way, as he "felt, limiting his freedom in the first place; and, secondly, "driving a wedge between himself and his fellows." Does co-partnership limit freedom? If we believe the utterances of those economists and philosophers who have given special thought to the subject, then our view is that the possession of property promotes, and does not detract from, individual liberty. We undertake to say that a man with something upon which to fall back in his own right feels freer than the man who has only something upon which to fall back (and that an insecure something) under the dispensation of a trades union. Whether it be freedom of thought or freedom of action, we maintain that the co-partner occupies, as an individual, a position superior to that of the member of the modern trades union who is not also a co-partner.

However we look at the matter, we cannot find anything hostile between co-partnership and a genuine trades unionism, as distinct from the socialistically controlled and militant order of unionism, which seeks to ride roughshod over all other human and industrial interests to gain its own ends. Therefore, we emphasize, by quotation, the concluding paragraph of Mr. Carpenter's paper: "Under co-partnership, "we have now incontestable proof that antipathy between "master and man dies down, and mutual respect and friend-"ship take its place. Trades unions will thus have no "further need for their cherished weapon, which they can "afford to throw aside, and to journey side by side with the "employers in a united pilgrimage towards the goal they "will seek, as they must always seek, in common—the "triumph of their industry."

As Viewed from Australia.

THE report published last week of part of the proceedings at the meeting of the Victorian Gas Managers' Association was much belated. It only reached the "JOURNAL" office the day before its publication in our columns, while the meeting was held ten months since. There were this year some special reasons for the delay; but we do urge our friends to see whether there cannot be a little more expedition in forwarding future reports, in order that within reasonable time we may supply technical colleagues at home with information as to how matters are proceeding in the Commonwealth. It is our wish to keep complete a live link between Australian friends and the industry in other parts of the world, by promptly publishing their proceedings.

As a set-off to this little grumble, we heartily congratulate the Association, as did their President (Mr. J. W. Thompson, the Chief Superintendent of the Metropolitan Gas Company) upon the progress in the numbers and interest of the members. As a means of communication, such an organization was much required; and there is no room to question the advantage that the industry in Australia has realized through the stimulation of interest and the circulation of knowledge that the Association has engendered and made possible. When the organization was in a nascent state, we predicted the benefit, and the founders (one of the foremost being Mr. Philip Holmes Hunt, the shortly retiring Chief Engineer of the Melbourne Gas Company) have been fully justified by the results of their initial work. This is shown by the brief presidential address published last week. It is clear that, though Mr. Thompson is not a man of many words, he is a man of broad comprehension; as is disclosed by the concentrated manner in which he presented the extensive qualification which is essential for the gas manager of to-day. The technical feature of the address, however, was the confirmation of Mr. Holmes Hunt's prediction, in his presidential address of now nearly four years ago, and since then in the paper presented by him to the Institution of Gas Engineers, that the vertical retort system would be the means of widening the commercial transactions of the local gas industry by enabling it to use in gas-making a hitherto poor coke-producing coal, and obtaining from it good quality coke. The coal in question was the Maitland, which yielded a small coke when working light charges; but the Dessau plant at Melbourne now produces from the same coal a fine quality coke, which is said to equal the coke-oven material, and is ideal for foundry work. It was with that (now achieved) object in view that Mr. Hunt selected the Dessau type of plant. Looking beyond into the com-

mercial field, the President urged the use of higher pressures in the distribution system, and foretold of the time when the gas industry will have, not only for the reason of equality of pressures, but also to get out of its distribution systems greater service, to adopt higher pressures with governing at the consumers' services.

This is a point that was also made at the meeting in the speech of the Hon. George Swinburne, in which he related some of the impressions regarding the home gas industry that he took back with him on the occasion of his visit to England in 1912, when he was one of the guests of the Institution of Gas Engineers on the occasion of the excursion to Cambridge. It was a very good tale that he had to tell. Despite the keen activity of the electric light people in the more wealthy residential and industrial centres, the British gas industry is waxing in strength more and more every day. The drift of expansion is in the supply of the means for improved lighting among the poor sections of the community, in recovering ground formerly lost, in meeting the requirements produced by a general growth of population and industry, and in the supply of gas for heating of all kinds and for industrial uses. Even during the weeks of August, there are gas undertakings (within our ken) that have been reaping increases as high as 12 per cent. on the corresponding weeks of last year. In such figures we have faithfully expressed one of the tendencies of the times. Mr. Swinburne was also impressed with the general increase in pressures at home. But, Australia being able to count so many small works, a matter likewise of present importance to the members was the one that served as a topic for the larger part of his remarks—that is, the beginning of the profitable employment by small gas-works in this country of Wilton's continuous sulphate of ammonia plant. With the scattered small gas-works in Australia, there must be there great loss of useful ammonia, and such plants should produce for them further revenue and economy which would largely enhance the stability of the concerns.

A New Case for Tar-Surfacing Roads.

ROAD authorities have done, and are doing, much to allay the inconvenience and troubles to human life and pleasure due to the growing accumulation of dust on our highways, and the still increasing attrition of road surfaces caused by the continued growth of modern traffic. There is no possibility of entirely abolishing road dust. It is an old evil that has been greatly magnified by the changed conditions of traffic; and it is therefore an evil with which some of our road authorities have more or less deliberately set themselves to cope. What they have done, however, is only part of what they must do, if we are again to have, in the summer time and during periods of dry weather, an atmosphere fairly dust free, if we are again to see the refreshing greenness of the roadsides and hedgerows unsullied by gritty coatings, and if we are to prevent the promotion of certain malignant diseases. Nature silently appeals for protection to be provided against the premature deterioration and destruction of some of its best works; and the human voice speaks, if not more eloquently, with still more emphasis. Some of our road authorities are—the producers of tar and pitch are well aware of the fact—more active than others in complying with the urgent claims to protection; but road deterioration being persistent, the efforts of all must be continuous, and must be enlarged. Very properly local authorities spend money on promoting sanitary conditions; they spend, too, much in directions that cannot be classified as utilitarian. But there are various ways in which more might be profitably disbursed in the prevention of disease. One of these is the spending of more money in obviating, by the now well-tried and efficacious means, this pernicious pollution of the atmosphere by flying dust, which lodges and penetrates everywhere—even into dwelling-houses, into lungs, and into epidermic wounds.

The Presidential Address that Sir James Crichton-Browne delivered to the Sanitary Inspectors' Association last week will, it is hoped, help to stimulate the stagnant brains of those road authorities who have done nothing in the matter of the suppression of road dust, or who have adopted such tight-fistedness over the matter that little good has been the result. They may now be moved to do something more, if only from selfish ends. The present monitor is not a scaremonger; and his words have to be considered seriously. They show that the community have a greater claim upon the road authorities in this matter, from the sanitary and health standpoint, than the mere one of the assuaging of an uncomfortable nuisance. Road dust varies in composition in accordance with local, seasonal, and meteorological conditions. But whatever its composition, it is, Sir James says, to be most feared as a carrier of disease. We know generally of the throat and bronchial, as well as tuberculosis, troubles that are set up and aggravated by irritation caused by dust; but the danger to be most dreaded is tetanus or lockjaw. Ordinarily, we regard this as a rare disease; but we have it sprung upon notice that the death-rate from it is showing a decided upward tendency. The means of mitigating this is by suppressing the formation of dust which, when stirred up, forms a carrier of the deadly organism of tetanus, which ordinarily lives in the alimentary canal of the horse, and hence is to be found in soil, dirt, or dust which contains horse manure. It is not suggested that all road dust contains the bacilli or spores of tetanus, nor does all road dust charged with these find its way into open wounds or sores in or upon the skin of human beings. But there is the danger; and the best possible barrier has to be put between these dangerous organisms and pregnable points of danger on the human being. The most efficacious way is to do all possible to obviate flying dust. There is this, however, to be said that Sir James did not say: The very traffic that causes the raising of the dust has taken from the road a large number of the animals that distribute the noxious germs; but, on the other hand, when there were more horses on the roads, the traffic was relatively slow-moving, and the carrying dust cloud not so frequent nor so dense. The use of motor cars has therefore made new road construction and surface treatment imperative.

There is another point. It is a rare thing to find any improvement in any direction without some ingenious person finds out or alleges some disadvantage. In connection with the use of tar, bitumen, or petroleum pitch, the scaremongers have raised the cry that it favours the setting-up of cancer, and that the use of these things in and on roadways must lead to a great increase of this terrible disease. Sir Crichton-Browne laughs in the faces of those who thus seek to inflame public alarm. "It may," he remarks, "be "safely affirmed that there is not the remotest risk of the "dissemination of cancer by the use of tar in road-making." The only possibility of mischief is through the repeated and constant application (for years) to the skin of the noxious material in some concentration, when the skin is prepared for the occurrence of cancer, and no such application is possible from the dust of tarred roads. In laying this particular and gruesome phantom, Sir James has done a good public service; for, to do them justice for misplaced assiduity, the opponents of the use of tar for road purposes have left no stone unturned to spoil the particular beneficial use of, and therefore new market for, this secondary product of gas manufacture.

The Photometrical Commission.

In other columns, there is a translation of the address of the President, M. Vautier, at the recent session of the Photometrical Commission at Berlin, on which occasion, subject to the ratification of the Societies solely concerned in the formation, and up to the present time in the work, of the Commission, the scheme was passed which will broaden its constitution and labours, under the title of the International Commission on Illumination. At this transition meeting, which marks a new era in the work of the body, it was fit that M. Vautier should devote himself to a review of the work accomplished, and of the proceedings that have led up to the present enlargement of constitution and action, as well as glance at the large field for work which confronts the extended body. It seems hardly possible that thirteen years have passed since we were present at the birth of the Photometrical Commission, and the honoured President of the International Gas Congress, M. Vautier, was elected President of the newly-formed Commission. But *tempus fugit*; there is no mistake about the thirteen years. The time has not been misspent. Some good and knowledge developing work has been done; and there is no lack of material upon which the Commission can labour to the general benefit in the future. We look for beneficial results emerging from the greater joint effort. While the work has no national bounds, the Societies at home will see to it (as the Institution of Gas Engineers have done in the past) that British views are properly represented at the deliberations of the International

Commission. In Mr. Clifford C. Paterson of the National Physical Laboratory, we have the Hon. Secretary of the Commission; and he may be depended upon for keeping the representative bodies at home well posted as to the proceedings, and well up to the mark in the matter of representation.

Hygienic Efficiency of Gas-Fires.

One result of the controversy that has taken place in our pages on the relation of the hygienic efficiency of gas-fires to heating efficiency, which culminated in the report by Mr. W. J. Atkinson Butterfield, M.A., F.I.C., upon his investigation into the subject (carried out at the instance of the Davis Gas-Stove Company, Limited), is that the invitation for tenders in connection with certain important gas-fire contracts have specified that the fires must be capable of passing the whole of the products of combustion through the flue-vent without the aid of a length of flue-pipe. It will be remembered that the results of Mr. Butterfield's research were that gas-fires can be, and are, constructed that will pass the whole of the products of combustion through the flue-vent without interfering with the room-heating efficiency, and that to fires of proper construction that will do this a reasonable length of flue-pipe can be attached without depreciating the room-heating efficiency. Many gas-fire purchasers on the large scale have evidently seen the importance of this in assisting them to ensure hygienic efficiency without (in the case of normal chimneys) being compelled to attach to fires variable lengths of flue-pipe to ensure that no portion of the products shall pass under the canopies into the rooms. We hear that there is hardly a firm of gas-fire manufacturers who are not to-day prepared to tender for fires that will comply with the new specification. All the better for the gas industry, and all the better the guarantee of hygienic efficiency when the fire is fitted up on the user's premises. It is conceded by most of the gas-fire makers (as our pages have shown) that the credit for what has happened, and is happening, is due to the missionary work, and their tenacity in upholding by proper means the principle that they laid down, of the Davis Gas-Stove Company. That what they have done in this matter is not (and they recognized that it would not be) to their entire commercial advantage, but only to their advantage in common with the other makers, is shown by the fact that one—we believe it is a fairly considerable—contract down south (in the specification for which the Davis standard of hygienic efficiency was prescribed), has, so it is commonly rumoured, gone to our friends who opposed the new standard for hygienic efficiency, and gave birth to the now famous "to wit" assertion as to additional heat units being wafted up the chimney. Some of the best of us have had to bend to wind and storm; and long since it was written that some would reap where they have not sown, while William Shakespeare came along afterwards (when nothing was known of the hygienic efficiency of gas-fires) and wrote: "Of our labours thou shalt reap the gain."

Electrical Cooking.

The thanks of the gas industry are due to Professor J. T. Morris, of the East London Technical College, for the frank paper that he read before the British Association on the subject of the cost of electric cooking. It will be seen from the principal parts of the paper published in other columns that the figures Professor Morris advances are "definite" ones, but indefinite as to their foundation. For example, there is no information as to whether the requirements of the household with which he deals are modest or extravagant in the matter of cooking, heating, lighting, and so forth. Judging the figures by those obtained from other houses, the requirements of the occupants of Professor Morris's flat are distinctly modest. In respect of other parts of the paper, it consists largely of generalities, of which there is a good stock in the electrical market at the present time. One of them is that those who have tried electric cooking know that joints of meat and steak are cooked better by electricity than by any other means. Well we have tried both electrically and gas cooked meats and other viands; and we are not prepared to support Professor Morris, either on the gastronomical or analytical test. Of course, there are cooks and cooks. Perhaps Professor Morris will inform us what he means by "cooked better;" and, taking two joints of like constitution, and cooked to the same extent the one in an electric-oven and the other in a gas-oven, we invite him to support his assertion by scientific facts. It was the British Association for the Advancement of Science, and not for the Advancement of Generalities, before a section of which Professor Morris read his paper. While on this point of meat cooking, it is interesting to find Dr. Fleming stating that no one who ever cooked electrically would want to give it up. The reply to this is that Professor Fleming should only speak for himself; for gas undertakings in several places know of gas-cookers in electrically equipped kitchens that are used, and gas undertakings know of electric-cookers that are now derelict, with gas-cookers re-established.

The Cost.

Professor Morris's flat is in the Marylebone area where the electrical conditions are considered to be very favourable. The residence consists of six rooms, a kitchen, and bath-room. The household appears to normally comprise five persons. The electrical service is on the fixed payment system, *plus* ½*d.* per unit. The period covered is twelve months; but we are not informed how long the flat was untenanted by the five ordinary tenants during the twelve months. We have our doubts, for certain reasons, about the flat having been tenanted for the whole period. One reason can be gathered from the paper. The hot water required is obtained by means of a coke-fed boiler; and the paper states that over a period of ten months the quantity of coke used cost £4 11s.; and yet coke *and* wood in the subsequent table are charged for the twelve months at £4 11s. But we have it that with £4 6s. 2d. worth of electricity for heating, and 8s. 4d. worth for lighting, at the ½d. per unit rate, and £4 11s. for coke (excluding the cost of a coal fire on the premises for part of the period), the total cost was £24 18s. 5d. for the year, or (as we suppose) the year less the unknown period when the family were not at home. But excluding the heating and lighting at ½d. per unit, the total paid for cooking and hot-water provision is £20 3s. 11d.

Comparison and Complaint.

There are no definite standards on which we can judge this figure. We do not know the time covered, nor the volume of work done. But it appears to us to be a heavy bill, the bulk of which is due to cooking. We know intimately of an eleven-roomed house entirely lighted by gas, in which all cooking is done by gas, which is partly heated by gas and partly by coal, in which all hot water is provided either by gas or by coal and coke. There are variously four and five persons in the house, excluding occasional guests; and the house is never untenanted. The total expenditure for gas, coal, and coke, for years past has not exceeded in any year £15, including rent of meter and cooker. However, Professor Morris did not end his paper without complaint. He finds with electrical work in the kitchen, there is "a disproportionately large expenditure to effect a comparatively trifling result." He has discovered, too, that the cooking utensils quickly lose their flat bottoms, which are essential to economy of time and energy. Professor Fleming also complains of the heating elements creating difficulty, and of trouble with most cookers of not being able to replace the elements without dispatching the cooker to the makers, which means alternative appliances. But if under Professor Morris's supervision, a better result than the one he shows cannot be effected in a six-roomed flat, then what will happen in a household where neither the head nor any member of the family is a trained engineer and electrician? We repeat that the gas industry thanks Professor Morris for his candour and information—so far as it goes.

Hysteria.

Profoundly as we deplore the whole of the circumstances connected with the Aisgill disaster, we can conscientiously say that, by the most dispassionate examination of the evidence advanced, we have been unable to find any cause for foisting or placing upon gas any part of the guilt for the fire. Our views were presented in last week's editorial columns. But over the use of gas on railway trains, the "Electrical Review" has in an article headed "Lest we Forget" shown that the subject has got such a hold over it that it is suffering acutely from hysteria. Here are the opening lines of the strange article:

> Lest we forget! Oh! that we could forget Aisgill! Oh! that we might for once shirk our duty and refrain from again perusing the ghastly details of one of the most heartrending and pitiful of the "avoidable" catastrophes which have blackened the pages of British railway history.

That we might wake up to find it to have been a distressing nightmare! That we might close the book and say: "What a very sensational piece of holiday fiction!" But it cannot be.

This all appears to come from the fact that two out of the three shattered and burned carriages were lighted by gas, and only one by electricity; and the "Review," in its excited judgment, has determined that gas, and nothing else, was the cause of the fire—notwithstanding the views of expert railway men, and the evidence to which we called attention last week. When our contemporary is again calm, we ask it to read that article. We have never known, nor have our electrical readers ever known, the "Review" to rave in similar manner when fires electrically generated have caused death, and when the electrical source of conflagration has been proved up to the hilt. Over the long, and ever-extending, list of fatalities caused by electrical means, the paper in question has never agitated itself in such painful manner as it has done on this occasion. It is a sorry spectacle.

And Contradiction.

We also understand that our contemporary, by inference, denies the accuracy of an important statement by Major Pringle in his report on the Hawes Junction disaster. It will be remembered that the Inspector wrote (though we admit that we could not, on the evidence, agree with him regarding the first part): "This is actually the first occasion when it can be proved beyond doubt that fire was occasioned by burning gas. It has to be remembered also that gas has been in use for lighting purposes for a very long period, and that during the whole of the time—in fact, since the year 1868—there is *no* case of fire destroying either the lives or bodies of passengers in railway accidents." This is a pretty clean record. It is no use referring to what is done on railways in other countries. The conditions are not altogether comparable with those in our own country. However, the "Electrical Review" (unmoved by electrical burnings) has a taste for dabbling in the gruesome details of railway accidents, if it can find that gas was on any of the coaches before the accident, or at any time prior to fire breaking out. It does not trouble itself as to what may have happened in the interim with gas under high pressure, and that gas lighter than air. On this occasion, it has certainly surpassed its previous performances.

Gas-Engine Research.

An announcement made in the report of the British Association Committee on Gaseous Explosions is of importance to the gas industry. The work of the Committee has not been carried out in any haphazard way by the constituent members; but it has been impossible to have any concentration of research work. This has been performed by the members in an individually isolated manner with the engines and appliances at command. The value of their thorough and patient work is not, however, less on that account. Through it information has been sifted and co-ordinated, and knowledge has been advanced. Now, however, the new laboratories of the Imperial College of Science and Technology will soon be completed; and they are to be devoted to research. Mr. Dugald Clerk (who we are sorry to hear has been very unwell, but is now making favourable progress) and Professor Dalby (the Secretary to the Gaseous Explosions Committee) are working on a scheme for equipping one bay of the new laboratories with internal combustion engines. It is recognized that the Imperial College would be materially assisted in carrying out their plans if the work of the Committee were concentrated in these laboratories. Professor Bone, who is also one of the members of the Committee, is Professor of Fuel and Refractory Materials at the Imperial College, and has supervision of the new Department of Chemical Technology. We look for some excellent and useful work connected with internal combustion engine research emanating from this fresh departure.

A Russian Exhibition.

While the minds of those connected with the gas profession are so largely taken up with the forthcoming display at Shepherd's Bush, a moment may be spared to draw attention to the fact that the Imperial Russian Technical Society are organizing an exhibition in St. Petersburg, to be open from Nov. 1 to Feb. 1 next. The official title is the Second International Exhibition of Lighting, Heating, Gas Carburating Apparatus, and Fire Extinguishing Devices; and the Managing Committee may be addressed at Panteleimonskaya, 2, St. Petersburg. The object is to show the present state of development in the directions named, as well as to demonstrate the comparative advantages of the various existing systems. Prizes will be offered for exhibits; and in connection with the exhibition there will be a congress at which matters relating to the branches of industry concerned will be discussed. The lighting and heating sections, of course, include gas, electric, oil, and alcohol lamps and stoves; and it is to be hoped that the first-named commodity will be well represented, so that visitors may be in a position to judge of the many advantages it possesses, in comparison with its competitors. The nine groups embracing lamps are sub-divided into a number of classes, among which are to be noticed (1) household lighting, (2) lighting of public buildings, theatres, halls, &c., (3) lighting of school buildings, and the like, and (4) lighting of municipal institutions, streets, &c. Then, in addition to the heating section, there is one devoted to measuring instruments, in which are groups for photometry and for instruments for measuring gaseous lighting materials. In St. Petersburg (as will be the case in London) people should during the next little while have full opportunities of making themselves acquainted with the great advances that have been made in the utilization of gas for obtaining light and heat.

The Melbourne Appointment.

Attention may be called to the fact that there is repeated in our advertisement pages to-day the advertisement inviting applications for the position of Engineer of the Metropolitan Gas Company of Melbourne, rendered vacant by the resignation of Mr. Philip Hunt. The time is now approaching when a selection from among the candidates will have to be made, in view of the early return of Mr. John Hinde, the Secretary of the Company, to Australia. By way of emphasizing the importance to the Company of securing the services of a man of unquestionable competence, it may be mentioned that, in addition to the exceedingly heavy work attending the gas inquiry some time ago, the present Engineer, Mr. Hunt, has recently had to conduct the case for the Company before the Commonwealth Arbitration Court, on an application by the trades unions for a very substantial increase in stokers' wages, following upon the award at Sydney. To save expense, both parties conducted their cases without the aid of barristers. The hearing took up 26 days in open court, besides consultations and preparation of the case; and Mr. Hunt's closing address to the Judge occupied almost six hours. It is hoped that the award will be a not unfavourable one for the Company; and if this anticipation is realized, much credit will be due to Mr. Hunt, who has, in connection with the case, had an altogether novel experience for a gas engineer. His management of the matter has been very favourably commented upon.

Presentation to Mr. F. C. Humphrys.

Hearty appreciation of the services of Mr. F. C. Humphrys, for many years Manager of the Ilkeston Corporation gas undertaking, and now the Assistant Engineer, found expression at a representative gathering on Monday of last week, when he was the recipient from the workmen who had served under him of a token of their regard. Recent equivocal treatment, since partly atoned for by the Council, of one who had been responsible for the control of the Municipality's chief revenue-earning concern, lent additional interest to the proceedings, which, under the presidency of Mr. J. Barker, the Chairman of the Ilkeston No. 1 Branch of the Gas-Workers' Union, took place at the newly-established headquarters of the local branch of the organization. The present was in the form of an inlaid hall barometer. Testimony having been borne by several of the employees to the good feeling which had prevailed between the recipient and those who had served under him, Mr. E. Trueman, a former member of the Gas Committee, said that confidence which had always been felt in regard to Mr. Humphrys had been by no means shaken by recent events. They all had their ideas as to the way in which the late Engineer had been treated in certain quarters. The best testimony which could be forthcoming as to the esteem in which Mr. Humphrys was held was afforded by the presentation made that night. One had never heard a single breath of suspicion against Mr. Humphrys during the whole time he had been in the town. The presentation was formally made by the foreman of the gas yard (Mr. G. Herberts), who had worked under the late Engineer for 35 years; and Mr. Humphrys, in response, alluded to the growth of the undertaking during his period of control—acknowledging also the loyal support rendered to him by the staff. Councillors Pounder and Bestwick spoke of the high esteem in which the recipient was held, and, as was inevitable from recent disclosures, the feeling found expression that Mr. Humphrys had been saddled with an undue measure of liability for action for which the Gas Committee was alone responsible.

PERSONAL.

Friends of Mr. Charles W. Bland will regret to learn that the late Miss Clare Sargant, of Sanderstead, near Croydon, one of the victims in the Aisgill railway disaster, was a niece of his. Miss Sargant was travelling with Mr. and Miss Lindsay, with whom she had been spending a holiday in Scotland. Miss Lindsay was also killed; while her father subsequently died from the injuries he received in the collision.

A good many happy thoughts are being woven into the scheme for the National Gas Exhibition; but one having a somewhat personal relation has incidentally come to knowledge. The members of the Executive Committee of the Exhibition accidentally learned that last Tuesday was the birthday of their hard-working Chairman, Mr. F. W. Goodenough; and as there was to be a meeting of the Executive that day, they had a preliminary "whip round" and purchased a birthday present for their Chairman. It took the form of a gold match-box, and the surprise presentation was made by Mr. D. Milne Watson, the General Manager of the Gaslight and Coke Company. In presenting the gift, Mr. Watson spoke of Mr. Goodenough's ability and liking for hard work, and said that, through these characteristics of their friend, he believed a large success was assured for the exhibition.

We learn from Professor J. W. Cobb, B.Sc., F.I.C., that the position of Research Chemist to the Joint Committee on Ventilation Research of the Institution of Gas Engineers of the University of Leeds has been filled by the appointment of Mr. W. Harrison, M.Sc., of Manchester. Mr. Harrison received his training at the Manchester School of Technology in the Chemical Department under Professor W. J. Pope, F.R.S., from 1901 to 1904. He was subsequently engaged as Analytical and Research Chemist to the Bradford Dyers' Association. He then returned to the School of Technology to carry out research work for a period of three years. He was awarded a research studentship in 1910, and in 1913 a research medal of the Worshipful Company of Dyers. Mr. Harrison has had a good deal of experience in technical research of various kinds, and is very highly spoken of by all those who have had opportunity of observing his work.

OBITUARY.

The death occurred recently, at the age of seventy-five, of Mr. William Jones, of Western Moor, Neath. Deceased was a well-known railway and water-works constructor, and had carried out important contracts in various parts of the kingdom—among them being the Cardiff Water-Works.

Deep sympathy will be felt for Mr. William Thomson, the Engineer and Manager of the Ramsgate Corporation Gas-Works, in the loss he has sustained by the death of his wife. Mrs. Thomson, who was the elder daughter of Mr. Charles Armitage, the Engineer and Manager of the Lancaster Corporation Gas-Works, passed away on Saturday at her father's residence, after a long illness.

SPECIAL GAS EXAMINATION AWARDS.

Winners of the Prizes Offered by the Society of British Gas Industries.

In connection with the prizes offered by the Society of British Gas Industries to the first and second candidates respectively at the final examinations in "Gas Engineering" and "Gas Supply," held by the Department of Technology of the City and Guilds of London Institute, we are informed by the Superintendent of the Department (Sir Philip Magnus, M.P.) that the following awards have been made on the last examinations. These prizes, it should be mentioned, are awarded provided that candidates are eligible under Rule 34 of the Department, which states that teachers, or persons registered as teachers, while eligible for certificates, are not eligible for prizes.

Gas Engineering.

First Prize (£3 3s.).—Mr. Harold Charles Edward Gripton, 31, King's Road, Windsor (Regent Street Polytechnic).

Second Prize (£2 2s.).—Mr. Harry Dumbleton, 40, Corelli Street, Miles Platting, Manchester (Manchester).

Gas Supply.

First Prize (£3 3s.).—Mr. Frederick George Marsh, 156a, Stoke Newington Road, N. (L.C.C. Westminster Technical Institute).

Second Prize (£2 2s.).—Mr. Sidney Alfred West, Gas-Works, Oakenshaw (Bradford).

Information has been received, from a special correspondent of the "Financial News," that a further large supply of natural gas was struck in another well last week, on the property of the New Brunswick Oil and Gas Field. The proved area is being rapidly extended; and there is felt to be promise of its developing nto the greatest gas field in the Empire.

ELECTRICITY SUPPLY MEMORANDA.

Our readers have recently heard of Mr. Horace Bowden, of Poplar. He is of the Point-Fives, and has a self-devised system of charging for electricity. Information regarding the system was a short time since given in the "Memoranda." Naturally he prefers his own system, respecting which we said when noticing it that the consumers would get into a mighty tangle, and would agree that it fairly had the better of their power of comprehension. Mr. Bowden, we gather, does not think that this matters much, as every consumer will be satisfied to know what his fixed charge is to be, and that in addition he has only to pay ½d. per unit. We have not found in any line of business that customers are so complacent as this over the charges that the retailer makes. However, Mr. Bowden does not like rateable value as the basis for the fixed payment, seeing that it can only be applied to domestic supply, and "therefore is not a system, but only partly one." This being so, he is in disagreement with the basis of charge adopted by the majority of the Point-Fives. This does not matter much, as Mr. Bowden is an optimist in regard to electricity supply, and a prophet of ill to the gas industry. Not far hence, according to him, the gas industry is going to have only the crumbs that fall from the electrical master's table. In a published letter, this is what he says:

The Optimist.

> The gas companies, in recent years, have found it necessary to outfit premises complete, and recoup their outlay by charging a higher price per 1000 cubic feet by means of a slot meter; but the result is that a good consumer pays an enormous sum for the use of the fittings, and a poor consumer causes a loss to the companies. Probably the average return is profitable; but when it is practical to instal electric lighting and cooking in workmen's dwellings, the good consumers will be the first to give up gas for economical reasons, leaving only the poor consumers to the gas companies, who will then be compelled to revise their system by charging a fixed rental.

We do not know the process of reasoning by which Mr. Bowden has arrived at these conclusions, nor do we know why it is that he has been selected for endowment with superhuman wisdom and foresight. We suggest to him that he should delete the "probably" before the words "the average return is profitable," and study the accounts of gas undertakings to ascertain that very few of the prepayment accounts can be unprofitable. Prepayment consumers can have ordinary meters if they chose, and are considered eligible for credit, or are prepared to pay a deposit. There is something vague about the words "the good consumers will be the first to give up gas *for economical reasons*." But later on we see that all poor consumers who are ratepayers are to be taken from the gas industry, for Mr. Bowden says: "When the time comes (and I do not think it is now far distant) when all ratepayers become [electric] consumers——" In other words, there is to be, according to Mr. Bowden, nothing left for the gas industry, and it—once, and at the present time, with great power in many markets—will be left sitting on the doorstep of the electrical industry bemoaning its cruel fate. The record of simple things in the Electrical Press continues to extend.

The Present and the Future.

Let us take the present conditions to test the strength of the future of the two competing industries. Coal and oil have gone up in price for both industries; but some of the electrical undertakings have been badly hit by the rise. In the case of well-managed gas undertakings, the increased product from coal and the good markets for residuals, with the increased gas business, have enabled them, despite the enhanced cost of raw materials, to well maintain their financial position. In residential areas where the electrical business is practically all for lighting, there have been some uncomfortable experiences, owing to increased costs, for the electricity undertakings, which experiences have been worsened by the reduced accounts promoted by metallic filament lamps. The end of this tendency is not yet; and, according to some prophets of further evil, the half-watt-hour-per-candle lamp is going in the not-distant future to knock down to one-third the lighting consumption per house. Electricity undertakings of every grade are urged to prepare themselves for the recession of consumption, and consequently of revenue per consumer. The managers desire to know how they are to prepare, by means other than raising the price of lighting current, which will have a bad influence on their business, with the economical inverted gas-lamp waiting to step in. "Develop your cooking and heating business" is the answer, to which reply is made: "That is easier said than done, and at 1d. per unit much cooking and heating will be wanted to profitably compensate for the loss in lighting units." There are also the barriers of first cost, unreliability, uneconomy, and the lower range of application of the electric-cooker than of the gas-cooker; so that the prospects in this direction are not good. For heating they are as bad, with dear electrical heat units, and the low radiant heating efficiency of the so-called "electric-radiator." The gas industry, on the other hand, has made some remarkable economies in manufacture, until the producing cost of gas at the station governor in works of modern equipment and method, is down at figures, with last year's values for materials, that are unprecedented—all through the

higher standard of working and good markets for residuals. Dr. Davidson, in the lecture published last week, predicts still further economy. Competition notwithstanding, gas undertakings are still selling gas for cooking and heating at lighting rates, and have not as yet descended (with the exception of very few cases where the system of differential charges has been the vogue for many years) to the making of any difference in the charges for the various lines of business. If need be, the gas industry could adopt differential prices, and better to-day (and better still when normal prices of coal are here) than ever before. The gas industry has not as yet a full grasp of the economies that the change of its standard of quality from illuminating power to calorific value will produce; but already knocking loudly at its doors are those who want to see a home-produced motor fuel. By no means can it be said that the industry is at the end of its economic developments in manufacture, nor in the appliances by which gas is utilized. The Horace Bowdens of the electricity supply industry should note these things.

Slow Lighting Progress.

That in some places the electric lighting business is not increasing by leaps and bounds is shown by a statement recently made by Mr. Roles, the Electrical Engineer of Bradford. The shopkeepers have been agitating for a reduction in the flat-rates of 4d. per unit for inside lighting, and 3½d. per unit for arc lighting, which agitation shows that they find these figures expensive. Information has been supplied to the Bradford Chamber of Trade by Mr. Roles, showing that 20 per cent. of the current supplied to shops is on the maximum demand system, and that if this were left out of consideration, and the flat-rates mentioned were reduced by ½d. per unit, the department would lose in revenue £4320 per annum. We do not know whether any agreement has yet been arrived at; but in the course of the discussion that has taken place on the subject, Mr. Roles has explained the influence which the large power output has in reducing the charges to lighting consumers. He points out that no great increase (comparatively speaking) in lighting units is possible, and gives data showing that in 1904 12,570,000 units were sold for all purposes, while in 1913 24,417,000 were sold—the revenue growing from £82,245 to £120,738. The lighting units, however, only increased from 2,226,000 in 1904 to 2,975,000 in 1913; and the lighting revenue from £36,700 to £40,608. Thus during the ten years there was an increase of 750,000 lighting units and of £4000 in revenue from this source; while the total output increased by some 12 million units, and the total revenue by nearly £40,000—showing the value to the department of low-priced units supplied for power and traction purposes. Mr. Roles does not look for any startling increase in the lighting units. It appears as though the saturation-point for electric lighting has been about reached, and that the rate of progress will be, as it has been now for some years, very slow. If a half-watt-hour-per-candle lamp comes along in the smaller units and for ordinary voltages, while connections may be stimulated, consumption for and revenue from lighting would decline.

A Meteoric Warning.

A paragraph prepared by "Meteor" for the readers of the "Electrical Times," and not for the consumers of electricity for lighting, ought to be brought to the notice of the latter, as it shows them how, by listening to the smooth-tongued electrical canvasser, they may have filched (and we think illegally in some cases) from them practically the whole of the monetary value of any efficiency improvements made in metallic filament lamps. "Meteor" advises the prompt adoption by electricity undertakings of the policy that will enable them to rob the consumers in this manner. "Meteor" may speak for himself, as we do not wish to have any share in any credit or discredit for his idea. This is what he says:

> We consider that the outlook renders it imperative for supply managers to arm themselves with differential tariffs, and to take active steps to persuade present and prospective consumers to adopt such tariffs. They should strive to collect the bulk of their earnings by way of fixed charges, making the secondary or running charge per unit as low as possible. If they can effect this, then their financial stability is far less likely to be perturbed by an irruption of half-watt lamps than if they worked on a flat-rate only. This is fairly obvious; but it can be made clearer by a simple example. Take a domestic lighting consumer who uses 240 units per annum. On a flat-rate of 5d. per unit his annual current bill is £5. If he were charged (say) on the Norwich system, at £4 10s. *plus* ½d. per unit, his bill would still be £5. Now assume that the time has come when he can change his present lamps for half-watt lamps of equivalent candle power. Under the flat-rate system, his bill is only £2 10s.; whereas under the differential system he will pay £4 15s. In the former case, the supply undertaking loses 50 per cent. of its revenue; in the latter case, only 5 per cent.
>
> In other words, a plan is advocated for robbing, under the conditions described, the consumer of £2 5s. This would make the charge 9½d. per unit; and we question whether this would be legal, under the circumstances of the illustration, where 8d. is the maximum statutory charge allowed.

Meteor's Support!

We are not disposed to let "Meteor" slip away from his self-chosen example of what he blunderingly chooses to call the "failure" of low-pressure gas. The "failure" we have dealt with before; but since then, as mentioned last week, he has quoted the Devonport gas undertaking as furnishing an example of the so-called "failure," on the ground that last financial year it incurred a net loss of £3491, whereas the year previously there was a surplus of £1645. In view of this drop in net profit, the self-opinionated adviser from the electrical ranks thinks that "unless the Devonport gas system can call in high-pressure gas to its aid, and distribute it pretty widely, it is doomed." This point was alluded to in the "Memoranda" last week; but being in a distant place when writing the note then published, the figures quoted could not be dealt with. There has been an opportunity since then of looking into them, with the result that it is found that "Meteor," like a certain girl, has taken "the wrong turning." To prove to his electrical friends the failure of low-pressure gas in Devonport, he should have told them that the consumption of gas in the borough in the past financial year was 424,236,530 cubic feet, which was an increase in the sale of low-pressure gas of 9·1 per cent.! Another figure might have helped him. The average number of meters per mile of main is now 318·72, as compared with 159·24 per mile in 1903—the first year of the Corporation control of the concern. The deficit in net profit appears to have been due not to the failure of low-pressure gas, but to the failure of the technical management, and to high cost coals. Coal last year cost 15s. 1d. per ton, as against 12s. 11d. The difference there was unavoidable. But the make of gas was upwards of 400 cubic feet less per ton than in the year before, which meant, to meet the demand for low-pressure gas, the carbonization of 1672 tons more coal than would have been otherwise required, besides having to pay the higher price for the whole of the coal used. There was also a reduction in the amount of coke produced for sale per ton of coal carbonized; and the cost of handling it increased. In other respects, too, the working was not good. It is sufficient to say that the technical management has been changed. If "Meteor" wants these matters before him in greater detail, he can have them by referring to the "JOURNAL" for June 17 last (p. 832). After reading this note, he will see that there is every reason for adding Devonport to the list of blunders he has made in dealing with gas affairs.

Free Gas-Cookers.

The writer of "Cooking and Heating Notes" in the paper in which our above-named friend operates week by week, thinks he has evidence that, in the matter of cooking, gas undertakings are playing a losing game. The writer in question states that he has "heard of three recent cases in London of offers by gas companies to supply, and fix free of charge, large cooking equipments, on the condition that electricity would not be used." We should like for interest to know the names of the gas undertakings concerned, because we are certain the statement is not true as applied to one of the London Gas Companies. However, while not sure about the attached condition, we should not be surprised at the offer to lend free of charge good gas-consuming equipments. There is nothing new in this. Several large towns have for years done the same thing down to domestic appliances. They have not regarded this as "open-handed generosity," and business men who have sufficient intelligence to consider the matter from a business point of view have not looked upon the action with suspicion, but rather as evidence of enterprise. Our friend waxes wroth over the matter, and makes himself appear silly by referring to the "lengths to which gas people will go in order to sell their unwholesome product." Poor myope! Short-sightedness is something for pity, and so is ignorance as to the qualities of a competitor. If the charge for electricity for cooking and heating was at the lighting rate, free electric cooking and heating appliances could be scattered about freely. But electricity, some electricians say, must be sold at ½d. per unit (and even below) to compete with gas for cooking and heating; and at this price there is no margin to be devoted to free supplied cooking and heating appliances to promote consumption. Moreover, gas-cooking appliances and their fitting-up run out much cheaper than electric cooking appliances; their constituent parts are such that they are not subject to the same wear and tear as electric cooking appliances; and should a consumer wish to discard them, they are still capable of renovation at a small cost for further use—so still contributing to the sale of gas. Our friend will see that the managements of gas undertakings are not such commercial imbeciles as he, from his narrow point of view and experience of these things, imagines.

Institution of Mining Engineers.—The twenty-fourth annual meeting of the Institution will be held in Manchester on Wednesday of next week, when the members will be welcomed to the city by the Lord Mayor (Sir S. W. Royse). The papers to be submitted include one on the "Absorption of Oxygen by Coal," by Mr. T. F. Winmill, and another on "Further Researches in the Microscopical Examination of Coal, especially in Relation to Spontaneous Combustion," by Mr. James Lomax. On the Thursday evening, a lecture on "Explosion Experiments at Eskmeals," by Professor Harold B. Dixon, M.A., Ph.D., F.R.S., and a reception of the members and their lady friends by Sir Thomas H. Holland, K.C.I.E., F.R.S., the President of the Manchester Geological and Mining Society, and Lady Holland, will take place at the University, Manchester. Arrangements have also been made for visits to places of interest, to works and collieries, and for other excursions.

NATIONAL GAS CONGRESS AND EXHIBITION, 1913.

LIST OF CONFERENCES AND POPULAR LECTURES—SUBJECT TO ALTERATION.

CONFERENCE ON FOOD AND COOKERY.

Saturday, Oct. 4, at 2 p.m.

To consider economical and correct methods of preparing and cooking food, especially in relation to cooking in the working man's home; their advantage to national health and physique; and how they can be made accessible to the poor.

Papers to be read:

"Cookery in its Relation to Health." By Joseph Priestley, Esq., B.A., M.D., D.P.H. (Medical Officer of Health for the Metropolitan Borough of Lambeth).

"Planning, Buying, and Cooking for the Working Man's Table." Hints as to food values, relative costs, and economical cooking methods. By C. Herman Senn, Esq., (Hon. Director of the Cookery and Food Association).

"The Cookery Class in its Relation to the Home." How to improve the working-man's table through the working-man's child, and thereby raise the standard of national health and physique. By Miss Mildred Atkinson, B.Sc. (Lecturer on Domestic Economy, Battersea Polytechnic).

"The Penny-in-the-Slot Meter as the Working Man's' Friend." How to get the greatest cooking value for a penny. By Mrs. Margaret M'Killop, M.A., Somerville College, Oxford.

CONFERENCE ON COAL SMOKE ABATEMENT.

Thursday, Oct. 9, at 11 a.m.

To discuss the use of gas for fuel in relation to the problem of the smoke nuisance.

Papers to be read:

"A Curse of Civilization." By Sir William Richmond, K.C.B., R.A.

"The Loss to Health and Pocket Caused by the Smoke Nuisance." The question of remedies. By Sir William H. Bennett, K.C.V.O., F.R.C.S.

"The Gas Industry in Relation to Smoke Abatement." By Professor Vivian B. Lewes, F.I.C., F.C.S.

"What the Coal Smoke Abatement Society has done and what it could do." By H. A. Des Voeux, Esq., M.D., &c. (Hon. Treasurer of the Coal Smoke Abatement Society).

CONFERENCE OF EDUCATIONISTS.

Saturday, Oct. 11, at 11 a.m.

To discuss the lighting, heating, and ventilation of schools; the physical and mental disadvantages of unscientific illumination; the teaching of cooking in schools; the arrangement and equipment of cookery and housewifery centres; &c.

Papers to be read:

"Some Considerations on the Brightnesses of Lights." By Professor Sylvanus Thompson, D.Sc., F.R.S., &c. (President of the Illuminating Engineering Society).

"The Physiological and Mental Disadvantages of Unscientific Illumination." Some conditions to be observed in the lighting of schools. By Leon Gaster, Esq. (Hon. Secretary of the Illuminating Engineering Society).

"Cookery in the School." Its relation to home life and domestic service. By Miss Mildred Atkinson, B.Sc.

"The School of the Future." Its lighting, heating, and ventilation. By Septimus Warwick, Esq., F.R.I.B.A., and Austen Hall, Esq., F.R.I.B.A.

CONFERENCE ON THE HYGIENE OF LIGHTING AND HEATING.

Tuesday, Oct. 14, at 2 p.m.

To discuss the hygienic aspect of gas for lighting, heating, cooking, and ventilation.

Papers to be read:

"The Hygiene of Gas for Lighting." Notes on research upon the hygienic value of gas as an illuminant. By Samuel Rideal, Esq., D.Sc., F.C.S., &c.

"The Health Value of Radiant Heat." Notes on research upon various types of heating appliances, having special regard to the comparative health values of heating by convection and by radiation. By Professor Leonard Hill, M.B., F.R.S., &c.

"Modern Improvements in Gas Lighting and Heating Appliances." By Professor Vivian B. Lewes, F.I.C., F.C.S.

"Gas in its Relation to the Equipment of Hospitals and Sanatoria." By Dr. Hawksley.

CONFERENCE ON THE SCIENCE OF ILLUMINATION.

Friday, Oct. 17, at 11 a.m.

To discuss the principles of scientific illumination, especially in their relation to the use of gas for lighting.

Papers to be read:

"The Aims and Objects of the Illuminating Engineering Society." By Leon Gaster, Esq. (Hon. Secretary of the Illuminating Engineering Society).

"The Economy of Efficient Lighting." Good lighting as an aid to increased output and a safeguard against accident. By Franklin Thorp, Esq.

"Light and Sight." The effect of unscientific illumination on the eye. By Meredith Young, Esq., M.D., D.P.H., &c.

CONFERENCE ON THE ECONOMICS OF THE HOME.

Friday, Oct. 24, at 2 p.m., and Saturday, Oct. 25, at 11.30 a.m.

To discuss the use of gas in its relation to (*a*) the artizan's weekly budget; (*b*) the economics of housekeeping for the middle classes; (*c*) the dearth of domestic servants; (*d*) the furnishing and equipment of the home.

Papers to be read:

"Domestic Service as a Career for Educated Women." How the substitution of gas for coal affects the domestic service problem. By Mrs. M. A. Cloudesley Brereton, Officier d'Académie, M.R.San.Inst.

"Fuel and Light in the Working Man's Budget." By Mrs. Margaret M'Killop, M.A.

"Coal Gas as a Fuel for Domestic Purposes." By F. W. Goodenough (Chairman of Exhibition Executive). [Based upon Cantor Lectures delivered before the Royal Society of Arts, March, 1913.]

"The Wife as Bursar." An all-round view of household expenditure. By Miss Mabel Atkinson, M.A.

CONFERENCE OF EMPLOYERS.

Tuesday, Oct. 28, at 11 a.m.

To discuss the relations of capital and labour; methods for insuring the welfare of employees; the apprenticeship system; technical and commercial education for workmen and staff; the relation of science and industry; the fundamentals of commercial success.

Papers to be read:

"Co-Partnership as a Means of Increasing the Prosperity of both Capital and Labour." By Aneurin Williams, Esq., M.A., J.P.

"The Relation of Science and Industry." An account of the work of the Imperial College of Science and Technology. By Surgeon-General Sir Alfred Keogh, K.C.B., LL.D., &c.

"Co-Operation between the School and the Employer." By Cloudesley Brereton, Esq., M.A., Cantab, L. ès L. Paris, Officier de l'Instruction Publique, and D. Milne Watson, Esq., M.A., LL.B.

"Natural Law in the Commercial World." By A. F. Sheldon, Esq.

CONFERENCE OF MANUFACTURERS.

Wednesday, Oct. 29, at 11 a.m.

To discuss the lighting, heating, and ventilation of factories, workshops, offices, and other places of business; the economic

value of adequate illumination; the use of gas as a fuel for industrial purposes; the use of gas for power; &c.

Papers to be read:

"The Lighting, Heating, and Ventilation of Factories and Workshops." By Professor Vivian B. Lewes, F.I.C., F.C.S.

"Gas as a Fuel for Industrial Purposes." By Professor W. A. Bone, D.Sc., F.R.S.

"The Economic Value of Adequate Illumination." By Leon Gaster, Esq. (Hon. Secretary, Illuminating Engineering Society).

"The Matching of Colours by Artificial Light." By T. Thorne Baker, A.M.I.E.E., F.C.S., F.R.P.S.

"The Evolution of the Internal Combustion Engine." By Dugald Clerk, Esq., F.R.S., M.Inst.C.E., M.I.Mech.E., F.C.S.

POPULAR LECTURES.

The following programme of widely varied popular lectures has been arranged with a view to affording reliable information to all who are interested in questions of health, comfort, and economy in the home, in the place of business, in the school, in the factory, and in the workshop.

"The Evolution of Gas Lighting and Heating" (A Series of Three Lectures). By Professor Vivian B. Lewes, F.I.C., F.C.S.

Thursday, Oct. 2, at 8.30 p.m., and *Tuesday, Oct. 14, at 8 p.m.

I. The pioneers of the gas industry—From the simple flame to the incandescent mantle—The construction of a bunsen burner—How a mantle is made—The use of increased pressure—The importance of efficient maintenance.

Saturday, Oct. 4, and *Wednesday, Oct. 15, at 8 p.m.

II. The uses of gas as a fuel—in the home—in industry—The advantage to the community of reducing labour and diminishing the production of smoke.

Tuesday, Oct. 7, and *Friday, Oct. 17, at 8 p.m.

III. The hygiene of gas lighting, heating, and cooking—The ventilating power of gas—The advantage to health of radiant heat—The bowl of water and the gas-fire—The dietetic value of the gas-cooker.

"From the Coalfield to the Burner." By Henry O'Connor, Assoc.M.Inst.C.E., F.R.S. (Edin.).

Monday, Oct. 6, and *Friday, Oct. 10, at 8 p.m.

A popular account of the manufacture, purification, distribution, and measurement of coal gas.

"The Contents of a Lump of Coal." By Henry O'Connor, Assoc.M.Inst.C.E., F.R.S. (Edin.).

Wednesday, Oct. 8, and *Thursday, Oct. 9, at 8 p m.

The residuals of gas manufacture (an industry without waste)—coke—tar and its derivatives—cyanogen—sulphate of ammonia—their economic value to the nation—enriching the soil of the country.

"Harnessing the Forces of Nature for the Service of Man." By Arthur J. Martin, M.Inst.C.E., F.G.S., F.R.San.I. (Past-Pres. Inst. of Sanitary Engineers).

Saturday, Oct. 11, at 8 p.m.

A consideration of the economic value of man's inherent laziness.

"The History of Fire Making." By Miller Christy, F.L.S.

Monday, Oct. 13, at 8 p.m.

"The Silent Servant." By Miss Constance Williams.

Friday, Oct. 3, and *Thursday, Oct. 30, at 8 p.m.

How the use of gas can minimize life's little worries.

"The Gentlewoman in her Kitchen." By Mlle. Claire de Pratz (the distinguished French Novelist).

Thursday, Oct. 16, at 8 p.m.

A Frenchwoman on the foundations of domestic happiness.

"The French Hostess and her English Sister." By Mlle. Claire de Pratz.

Saturday, Oct. 18, at 8 p.m.

The Kitchen as "the hub of the household."

"The Construction, Operation, Testing, and Reading of a Gas-Meter. By W. H. Y. Webber.

Monday, Oct. 20, and *Saturday, Nov. 1, at 8 p.m.

A vindication of a much-maligned character—with some hints to the gas consumer.

"The Origin and History of Artificial Lighting and Heating." By Edward Lovett (of the Folk-Lore Society).

Wednesday, Oct. 22, at 8 p.m.

The first fire—The candle-lamp of the stone age people—lamps for the dead in pre-historic times—shell-lamps and bird-candles—The cruzie lamp and its variations—pine-splits and rush lights—The origin of the hearth—farm fires that never went out—portable stoves and kangris—curious ideas of cooking—the past and the present: a comparison.

"Some Practical Hints on the Use of Gas in Factory and Workshop." By W. H. Y. Webber.

Tuesday, Oct. 21, *Wednesday, Oct. 29, and *Friday, Oct. 31, at 8 p.m.

The utilizations of gas for lighting, furnace, heating, and power purposes in commerce and industry.

"Hints to Gas Consumers on How to get Value for Money." By John Young, M.Inst.C.E.

Thursday, Oct. 23, and *Friday, Oct. 24, at 8 p.m.

On how to avoid waste and secure efficiency in the use of gas in home, shop, factory, church, hospital, and other institutions.

"The Use and Abuse of Light." By Leon Gaster (Hon. Secretary, Illuminating Engineering Society).

Monday, Oct. 27, at 8 p.m.

Some hints on how light should be used to secure a maximum of advantage to health and pocket with a minimum of damage to sight and physique.

"A Pennyworth of Gas." By C. W. Saleeby, M.D., F.R.S. (Edin.).

Saturday, Oct. 25, and *Tuesday, Oct. 28, at 8 p.m.

The penny-in-the-slot meter as the worker's friend—A revolution in cookery for the million—A silent social reform.

[Those lectures marked with an asterisk (*) will be repetitions of lectures given on previous dates.]

INTERNATIONAL PHOTOMETRIC COMMISSION.

The President's Inaugural Address.

The following is an abstract translation of the address delivered by M. Vautier, of Lyons, the President, at the opening, on the 27th ult., of the special meeting at Berlin of the International Photometric Commission. It will be remembered that this meeting had been called solely with a view to the reconstitution of the Commission on a wider basis, and for the settlement of statutes for the new Commission, which will be known as the International Commission on Illumination.

The fourth session of the International Commission on Photometry, which is now beginning, takes place in very special conditions, and it will, therefore, be interesting to review briefly the circumstances which have led up to it. The Commission was founded by the International Gas Congress which met at Paris in connection with the Exhibition of 1900. Nine countries which had technical Gas Institutions took part in that Congress, and the chief purpose of the Commission was the study of directions for photometry as applied to incandescent gas lighting. This involved instituting researches aiming at the improvement of gas lighting, and, incidentally, the study of some general photometric questions which were independent of the kind of lighting.

The Commission has achieved important results in both directions. In the one, for instance, there have been the masterly researches of M. Sainte-Claire Deville as to the part played by the calorific power of gas in incandescent lighting, and, in the other, the notable comparisons between flame standards of light, undertaken, by desire of the Commission, by the National Laboratories of England, France, and Germany. The first-named researches (thanks to the experience and repute of the investigator and the manifold resources of the Compagnie Parisienne du Gaz) enabled the Commission to express the view that: "The determination of the illuminating power of flames has lost its significance, and the estimation of the calorific power of the gas, being a true criterion of its quality, ought to take the place of the determination of its illuminating power." This is a conclusion of the greatest importance to the gas industry, since it suggests that its manufacture should be controlled by reference to a well-defined and universally recognized physical quantity, instead of by a quantity varying with the apparatus employed for its measurement, and with which it is impossible to obtain any comparable results with gas of differing origin tested by the statutory methods of different countries.

The comparison of the flame standards of light has been carried out, in the laboratories already mentioned, by Messrs. Liebenthal, Paterson, Perot, and Laporte. The results of their work were presented to, and discussed by, the Commission, which arrived at an agreement in its second session and adopted ratios for the light of the Carcel, the Hefner, and the Harcourt lamps which have since been published. An unexpected but very interesting development ensued. The work showed that, with specified degrees of atmospheric humidity, the English and French units of light had the same value, which is so near to that which had been accepted in the United States that the Bureau of Standards at Washington resolved to adopt it also. The Bureau of Standards, the National Physical Laboratory in England, and the Central Electrical Laboratory at Paris agreed to accept the same value

for the unit of candle power. The technical Gas and Electrical Institutions have also adopted it. The understanding is, therefore, authoritative; and in America, England, and France one unit has thus replaced three former units of candle power. The simplification thereby achieved is an illustration of the good results to be attained when such questions are approached solely from the scientific standpoint.

The fact that only these results of the work of the Commission have been referred to does not imply that others were not worthy of mention, nor that the two directions named cover all the subjects of investigation. Such an impression will be dispelled by a glance at the programme of researches drawn up by the Commission for the guidance of industrial and scientific investigators. But the matters alluded to in the foregoing illustrate the nature of the inquiries which a technical commission, whether international or not, ought to pursue—viz.: (1) Work of special interest to the individual lighting industries; and (2) work of recognized value to the lighting industry as a whole.

In the organization which is to be settled at this meeting, it will be necessary to meet in both these respects the requirements of the industries represented, and in such a way that each industry may be at liberty to pursue independently, and in a permanent manner, any work more especially concerning itself and aiming at improving its lighting methods. A Commission which restricted its scope to purely scientific studies, definitions of magnitudes and photometric units, and the investigation of standards of light, would certainly be useful in the highest degree. But vast though its scope would be, it ought not to expect to absorb established bodies, the programme of which includes not only these important questions, but also improvements which may be anticipated from the application of science to technical methods in use. The new organization is not, however, precluded in consequence; for it may embody distinct sections—as is the case with a number of industrial bodies which combine in a single group various kinds of learning.

The International Photometric Commission has very clearly indicated that it is desirable that the scientists and representatives of various lighting industries should meet for the consideration of questions which are not peculiar to one of the industries in particular. Thus it decided in its session of 1911 to ask the Electro-Technical Committee of each of the nine countries represented in it to send delegates to participate in the consideration of all questions of common interest—such as the definition of magnitudes and photometric units, &c. This decision had been made known through the Technical Press; but before it had been officially communicated to the bodies in question, the Illuminating Engineering Society of New York laid before the technical Gas and Electrical Institutions a proposal for the holding of an International Congress, in which delegates from these Institutions would meet to discuss and adopt an international agreement as to the definitions and symbols of the magnitudes and units employed in the photometry of illumination.

The Institutions, while admitting that international ruling on this question would be highly desirable, for the most part thought that the initiative in arriving at an agreement of this kind should be taken by the International Photometric Commission, because it was a well-organized international body engaged in photometric investigations. They pointed out, further, that in its last session the Commission had appointed a Committee to study the proposals of the Illuminating Engineering Society. As a consequence of these representations, the latter Society at once agreed to defer its scheme.

The proposal of the International Photometric Commission had meantime been favourably received in the circles interested; but the representation which it had been proposed at Zürich to give to the electric lighting industry did not appear to the latter to be quite large enough. The Gas Institutions were to have been empowered to nominate a maximum of six delegates (or only two for unimportant countries) while the Electrical Institutions were to have nominated only two. It was not the intention of the Commission, in making this difference in the representation of the two industries, to put one in a position of inferiority to the other in regard to questions of common interest. This is shown by the fact that votes were to be taken according to country, and not according to the number of delegates; and it is evident that the vote of each country could be given only after agreement between the representatives of both industries, irrespective of their number. Otherwise, the decisions of the Commission would not have had the authority which it was desired to secure. Actually it had seemed logical to make the number of delegates from each special branch proportional to the nature of the resolutions under consideration. Thus resolutions of general interest—*e.g.*, referring to the adoption of photometric definitions—commonly are the sequel to prolonged preparatory work on which there will generally have been correspondence between a certain number of specialists or experts. The full session of the Commission would ordinarily be held only after preliminary agreement had been so far accomplished that the sanction of the Commission would be practically assured. In these conditions, it appeared unnecessary for each country to send a large number of delegates to record its vote. If the Commission had had no other work in mind, it would undoubtedly have suggested equal representation for each industry. But apart from work of general interest, the Commission has still before it a programme of questions relating exclusively to the gas industry; and for their consideration, it is desirable to have a sufficiently large number of delegates whose experience would assist to clear up and further questions which would not necessarily involve the passing of any international resolution.

However, in the spring of 1912, the American Gas Institute wrote to the Photometric Commission that in its opinion—

> The best and most permanent results will be obtained if the method inaugurated by this Commission (in its resolution to invite the representatives of the National Electro-Technical Committees) would be enlarged in such a way that the International Commission of Photometry could represent completely all the interests of illumination on an even footing and under reciprocally acceptable conditions, involving the Illuminating Engineering Societies of New York and London, besides the National Laboratories and the Technical Societies of Gas, Electricity, Acetylene, and others. If the Commission should not think it opportune to enlarge itself in such a way, and prefer to remain exclusively a Gas Commission, it would still be advisable for it to take the initiative of sending an appeal to all the chief societies interested in photometry, and ask them to participate in the formation of an International Commission, which would treat all questions of nomenclature and units used in photometry. On choosing the first alternative, the International Commission of Photometry would be responsible towards all photometric interests represented in the Commission; it would become an International Commission of Illumination.

These views have been approved by the various technical lighting institutions of the United States. The American Gas Institute deputed Dr. Hyde to propound them to those principally interested in Europe. In the course of his journey, Dr. Hyde visited the heads of the principal technical Gas and Electrical Institutions in the countries represented on the Commission, and ascertained from them that opinion in the circles interested was unanimously in favour of the expansion of the International Commission in a manner which would make it representative of all important lighting interests.

The American Gas Institute had suggested that, in this case, the work of preparing a scheme of Statutes with this object should be entrusted to a Sub-Committee, consisting of representatives of the National Laboratories of America, Austria, England, France, and Germany, since a Committee thus constituted would naturally be impartial. He (M. Vautier) had, therefore, asked Messrs. Brodhun, Kusminsky, Laporte, Paterson, and Rosa to assist in this matter, and Mr. Paterson had kindly agreed to act as Secretary, and to prepare a preliminary draft. This was done, and the draft circulated among the other members of the Committee, who returned it with their observations. Mr. Paterson then drafted a second document, in which he endeavoured to harmonize as far as possible the various suggestions of his colleagues. This draft was duly approved by the Sub-Committee, and subsequently transmitted to all the technical Institutions. In the document, Mr. Paterson states that he and his colleagues are of opinion that a general basis of agreement exists in regard to the new constitution of the Commission, and it is very desirable that there should be arranged for September next a meeting of the Commission, in which representatives of the different industries and different countries would participate for the purpose of discussing and passing the new Statutes. He asks the Technical Institutions if, without previously committing themselves to the new Statutes, they would approve of this meeting and send delegates to it; such delegates being nominated by them or by a National Lighting Committee to be formed by them. Also that they should agree that, on motions regarding items of the Statutes, each country should have the same voting power irrespective of the number of delegates present, that for each country the representatives of gas and electricity should take an equal share in the voting, and that resolutions regarding the Statutes be passed by a majority of votes of the countries represented.

These proposals were approved by the Institutions who replied, though several did not reply or reserved their opinion as to the mode of representation. The technical Gas and Electrical Institutions of the nine countries were thereupon invited to participate in the projected meeting. The German Institutions at once agreed to be represented through the Deutsche Beleuchtungs-technische Gesellschaft (the German Illuminating Engineering Society); the American and English institutions formed National Committees who appointed delegates, and in other countries, the technical Gas and Electrical Institutions each appointed their own delegates. [The Swiss Institution of Electrical Engineers, though expressing interest in the work, did not appoint delegates.]

The foregoing is a sketch of the preparatory work which has happily culminated in the present meeting; and the number and names of the delegates reflect the importance which the various Institutions have attached to it. New statutes have now to be settled; and this work will prove to have been greatly facilitated by the draft which the Sub-Committee proposes should be taken as the basis for discussion. The thanks of the meeting are due to that Committee, and to Mr. Paterson, its Secretary, in particular, for the trouble which they have bestowed on this work. The draft statutes have been sent, well in advance, to each delegate, in order that he might study it beforehand.

It is important, in such a matter, to make the regulations broad enough to give the Institutions of the different countries the fullest liberty to proceed in the manner which accords best with their particular work, customs, organization, and ideas. Actually this is the more necessary in this particular case, because the future Commission will have the peculiarity—among international bodies—of bringing together for work of common interest the representatives of industries of which not merely the modes of production or manufacture are totally different, but which are in competition commercially. This exceptional position, however, ought not to

involve serious difficulties, if sufficient regard is taken of it in organizing the future Commission. From this standpoint, the mode of representation specially demands attention. It is unnecessary that there should be a uniform mode—all that is required is one which allows the industries concerned to be represented in the manner which they think most beneficial.

M. Vautier proceeded to refer to the relative advantages, &c., of representation through National Committees appointed by the technical Institutions, and by delegates directly appointed by the latter. He further pointed out that separate gas and electrical sections were desirable for the discussion of questions pertaining solely to one of the industries. He expressed a hope that the continuity of the existing Sub-Committees, appointed at the last Zürich session of the Photometric Commission to report upon various scientific and technical questions would be preserved. Finally, he thanked Dr. Brodhun, who had acted as local organizing Secretary, and Professor Warburg, the Head of the Imperial Physical-Technical Institute (Reichsanstalt) at Charlottenburg, for the kindly provision they had made for holding the meeting at that Institute. He then declared the session open.

GAS COOKERY BOOKS.

From Messrs. Fletcher, Russell, and Co., we have just received two cookery books, both of which we are authorized by a domestic authority of personal close relationship to pronounce as good. The first one is a new and extended edition of the popular "Housewife's Manual of Domestic Cookery, with Special Reference to Cooking by Gas," edited by a no less competent specialist than Mrs. H. M. Young. That the new issue will find great favour is assured by the fact that the issue of the original book ran into many thousands of copies. The publication of the book is in the hands of Messrs. Simpkin, Marshall, and Co., Limited. The price is 2s. net; but we have no doubt the managements of gas undertakings who require large quantities of the work would be treated by the publishers on favourable terms. As to the contents, the book is not intended for the working class; but it may be described as essentially one for middle and upper class households. Among new features, there are 130 more recipes in it than in the former original issue; and though we cannot personally vouch for the correctness of the recipes so well in cold print as we could do when they materialized, we are content to accept them as being what they claim to be, in view of the fact that Mrs. Young affixes her name to them. Each section of recipes is preceded by notes in plain language directed to securing the best results by proper preparation of food and correct management of the gas-oven and its adjuncts. In more than one place, Mrs. Young, with her extensive experience, praises the gas-cooker for the good results achieved, owing to the precision with which temperatures can be regulated. There is a chapter in which we read of the causes and remedies of the waste of gas, of the low cost of gas cooking, and of the management of the cooking ranges. We predict that history will repeat itself, and that the reception of the first issue of the book will again be witnessed with the second issue.

The other cookery book that comes from Messrs. Fletcher, Russell, and Co. is of an altogether different character. It is designedly a less pretentious book, written by Mrs. A. M. Collins, who is cookery demonstrator to the firm. It consists of only about seventy pages; and the recipes are of a simple character. This is the feature of the book; and it meets a much felt want. We hear a good deal about plain cookery; but when the wife of a working man gets hold of one of the ordinary cookery books with, in the recipes, words beyond her intelligence, and ingredients either beyond her experience or depth of purse, she puts the book down in despair of ever gaining any, to her, useful information from it. Mrs. Collins has set out, and successfully, to meet the want; and the recipes are pronounced good, simple, and cheap by the domestic consultant nearest at hand to the writer. Mrs. Collins devotes some space to notes upon the proper management of a gas-cooking stove. It may be suggested to gas companies that this little book should be widely distributed, free of cost, among their prepayment and small ordinary consumers; for it is among them that instruction is chiefly required. From Messrs. Fletcher, Russell, and Co. single copies and small quantities can be secured at the rate of 3d. per copy; but special terms, we understand, will be arranged for large quantities.

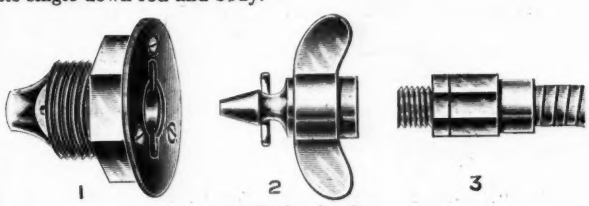
Wales and Monmouthshire District Institution.—The autumn meeting of the Wales and Monmouthshire District Institution of Gas Engineers and Managers will be held in the Beaufort Arms Hotel, Chepstow, on Wednesday of next week (the 24th inst.), when the incoming President (Mr. H. D. Madden, of Cardiff) will deliver his Inaugural Address. Among the general business on the *agenda* is the consideration of the arrangements to be made for the visit of the Institution to the National Gas Exhibition on Oct. 15. After the meeting, there will be luncheon at the invitation of the Chairman and Directors of the Chepstow Gas Company. The afternoon will be devoted to an inspection of the gas-works (under the direction of Mr. James Robb, the Manager), and a drive. Later, members will take tea with Dr. Lawrence, the Chairman of the Gas Company, at his private residence.

NEW BLAND GOODS.

Fully equal in general get-up to its predecessors, the catalogue for 1913-1914 of the Bland Light Syndicate, Limited, of No. 29, Little Trinity Lane, E.C., exceeds them in size; and on perusal it will be found to contain things both useful and ornamental connected with both indoor and outdoor lighting.

To mention first of all the popular Bland inverted burners, these can now be obtained in porcelain, in two colours—rich brown to match antique copper, and new jade to match polished brass. This will no doubt prove an exceedingly attractive style. Semi-indirect lighting is making much headway in public favour; and the Syndicate have a good selection of beautiful bowls for use with fittings adapted to this system of illumination, as well as a number of handsome fittings themselves, made in polished brass, old gold, antique copper, or oxidized silver finish. One pattern specially suitable for offices, warehouses, &c., is provided with an enamelled steel deflector above the burners. For high-pressure lighting, the firm are well equipped. There is a new type silent rotary compressor, suitable for working at any pressure from 10 to 100 inches water-gauge; and an indoor burner, to suit any conditions within these limits, is so constructed as not to afford any places for lodgment of dust or fluff, while the products of combustion are taken away quite clear of the air chamber. These lamps are made in sizes giving from 60 to 300 candle power; the efficiency claimed being 60 candles per cubic foot of gas consumed. There is also a new type "Blanlite" high-pressure outdoor lamp, of 1000 candle-power, for both street and shop lighting. This is in copper throughout, with white enamelled deflector; and is suitable for pressures of from 54 to 100 inches water-gauge. It is British made, wind and rain proof; and all parts are easily accessible. The well-known No. 15 "Blanlite" outdoor lamp is now also made as a high-power low-pressure lamp, with from one to four lights; the stated candle powers being 200 to 800.

There is shown attached to this lamp, and also to a street-lamp, Burch's patent outside lighting arrangement. This convenient device, which can also be attached to outdoor lamps of other patterns illustrated in the catalogue, is the invention of Mr. A. R. Burch, of Bombay. On one side of the lamp there is a receptacle connected by an inclined tube with a cast-iron hood fixed over the burners. When the gas is turned on, the hood fills with a combustible mixture, which travels along the tube to the receptacle first mentioned. Here it is ignited by a torch, and the flame passes to the burners. Thus the need for a bye-pass is done away with in a simple manner. With regard to the wide range of tasteful fittings illustrated, all that need be said generally is that they cater for all tastes and all situations. The same remark applies to glassware and shades. Where two-light inverted burner pendants are desired, the registered "Unique" pattern (which can be had in various styles and finishes) may be commended. These pendants [which have already been referred to in the pages of the "Journal"] were designed by Mr. F. J. Gould. As was pointed out when noticing them before, they constitute a departure from the ordinary lines that are associated with the gas-pendant, with its single down-rod and body.



A Wall-Plug for Gas.

Before leaving the catalogue, attention may be directed to just one other novelty. This is Spicer's patent wall-plug for portable lamps or fires, which enables gas consumers to enjoy those advantages which are claimed by electricians for their own wall plugs. The idea of the inventor was that in removing from the gas terminal the flexible tube attached to a portable lamp, there was danger of the tap of the terminal being left on; and he set himself to obviate this, by devising means whereby the removal of the flexible or other connecting tube should cause a tap to be turned off, or the terminal to be otherwise closed. The method adopted of securing this end will be gathered from the illustration. Fig. 1 shows the plug ready for fixing. The front plate only is visible when fixed on the wainscot; the thread on the inside being screwed to the existing supply. Fig. 2 is the winged key connection. By inserting the taper plug and turning to the right or left, a gas-tight connection is made, and a supply of gas secured, through the rotating of the plug by means of the projections which engage in recesses in it. On the other hand, the act of turning back the joint-piece to disengage it causes the passage through the terminal to be closed. Fig. 3 shows an ordinary flexible tube connection for attachment to a reading or standard lamp, &c. A number of these devices are already fitted; and, indeed, it is an arrangement for which plenty of use should be found.

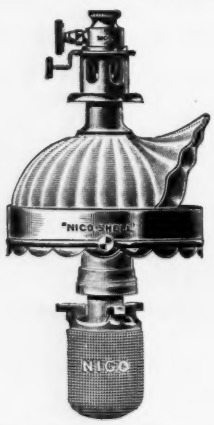
Mr. William Ball, J.P., a Director of the Rochester, Chatham, and Gillingham Gas Company, left estate of the gross value of £106,959, of which the net personalty was sworn at £81,698.

NEW DEVELOPMENTS BY THE NEW INVERTED COMPANY.

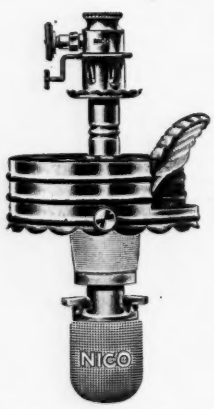
We well remember the day when inverted gas-burners for domestic and general interior lighting were selling at something like 5s. 6d. and 6s. 6d. apiece, and when for this sum something that was more novel than dependably efficient was obtained. But since that day, efficiency and reliability have ascended and prices have descended, until, at the present time, at very cheap rates, the very best value can be obtained in the shape of inverted gas-burners. To-day, there is no excuse for buying shoddy inverted burners; there is no excuse for not getting long life combined with high efficiency at a very moderate price. There is no reason, too, why burners should not now be obtained constructed with porcelain tops and protection for fittings that will completely avoid the old eyesore of discoloured or encrusted fittings that threatened at one time to limit the application of the incandescent light system. We see these things at the show-rooms of the New Inverted Incandescent Gas-Lamp Company, Limited, at No. 19 & 21, Farringdon Avenue, E.C. Somehow or other when we remember the pioneering work in the inverted line of this Company, we are always prone to drop into a comparison of things as they were and things as they are. "As they are" shows wonderful progress.

Cheap, Interchangeable, and Protected Burners.

Here we have what is called the "Nico-Shell" burner, the good points of which and the old bad points of inverted burners are as wide asunder as the poles. Yet we do not remember anything cheaper in the way of a burner emanating from the Company; and it is going to become very popular. It is a burner that will deal with straight coal gas or mixtures, and at any pressures, and will give (as an examination of the flames show) perfect combustion and a consistent flame, and therefore a permanence of high illuminating power, being rated at 80-candles per 3 cubic feet per hour. The burner is well made. It is fitted with a shell-top of white porcelain, and has a large lateral opening for the products of combustion, so that neither burner top nor connecting fittings can become tarnished or coated by the action of the products on the metal. The porcelain top of the burner in some styles is gilded choice rests with the buyer); and, with either the white or gilded



The "Nico-Shell" Burner.
(Interchangeable Nozzle.)



The "Nico" No. 18 Burner.
(Interchangeable Nozzle.)

top, the burner presents a very clean appearance. We saw the various forms of the burner connected to some choice fittings; and they looked well, and were doing well. There is another feature. The burner is of standard size, but the nozzle part is interchangeable, so that the burner (through the excellent gas and air adjustments of "Nico" make) can be used with both ordinary and medium sized mantles. The advantage of this interchangeability is too apparent to require any commendation. Every part of the burner is well made, and carefully proportioned, so that whatever the conditions requisite as to the gas and air volumes, they can be realized, and the proper admixture be obtained. Just below the taper of the bunsen is a large expansion and mixing chamber; and therein, with the delicacy of the means of adjustment, is found the secret of the range of the burner. The metal burner tube is protected by a magnesia outer tube, into which is screwed the nozzle for either the standard large size mantle or the medium size one. By the change from the one to the other nozzle and mantle, there is, with gas and air adjustment, no alteration in the ratio of light efficiency to consumption. In every way the Company have in designing this burner combined utility, efficiency, and protection; and, this being so, we need not refer to the minor details. It is the cheapest burner the Company have ever put on the market; and it has turned out to be the best. This being so, there is good ground for saying for it a favourable word.

These is also the No. 18 new type "Nico" burner, which is similar in construction, so far as the bunsen tube and adjustments are concerned, to the "Nico-Shell" burner; and the nozzles are likewise interchangeable. The difference is that it is fitted with a conical china cone and deflector; and it has a hood for the protection of the fittings above, but not of the shell shape as in the previously described burner. It can claim the same virtues as the shell pattern, but for appearance the latter we rather fancy will be more popular.

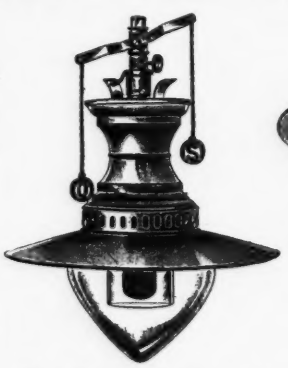
The "Nico-Flexible" Mantle.

Made of fine mesh and with an artificial silk base, the "Nico Flexible" mantles are well worth special attention. When one is shown a mantle which one can almost press into concertina form, and its resiliency is so great that it springs back into its shapely form; or when one presses its side so as to disform the mantle without fracturing it, and, on removal of the pressure, it assumes at once its normal shape; or when one removes a globe and accidentally knocks the mantle, and it is indifferent to it; or when one treats the mantle to a great deal of vibration, and it does not succumb——that is the "Nico Flexible" mantle. This statement shows that the mantle structure is not brittle; and the less brittle the filaments of a mantle are, the greater will be the amount of vibration that it will withstand. The "Nico-Flexible" mantle is, we learn, being experimented with at the present time in certain streets of London; and the streets of London to-day, in view of the character of the traffic, supply the best mantle testing machine of which we know. No complaint has yet been heard of the mantles under trial—in fact, they are showing themselves to be exceedingly good-tempered mantles. The price is perhaps a little higher than some other types; but in regard to mantles, the highness or lowness of price should always be measured by their useful life under the circumstances of their employment. The mantles are made in all the standard sizes; and they are particularly valuable for factories and street lighting, and any place where vibration obtains.

The "Nico-Flexible" Mantle.

The "Nico" Indoor High-Power Lamp.

This is a lamp that, although only recently introduced, has already been received with considerable favour. It is a lamp that is essentially useful for the lighting of spacious interior places—such as shops, factories, schools, halls, and other interiors where large units of light are required. The lamp is extremely well made; and its appearance, in its white enamelled casing relieved by gold lines, is all that can be desired. Having in view both appearance and efficiency, we are also favourably impressed by the price of the lamp. The mantle is larger than the ordinary; and the illuminating result is great. The illustration shows the lamp. In the ordinary form, it is fitted with an inner glass round the mantle. The construction of the lamp shows that the products of combustion are kept completely separate from the



The "Nico" 300-Candle Power Indoor Lamp.

The "Nico-Reflex" Lamp.
(Semi-Indirect Lighting.)

air supply to the lamp, and that the upward flow of the products assists, by the aid of the inner glass, in warming the secondary air supply. The flow of the secondary air over the mantle is also accelerated by the upward pull of the hot products. The lamp is fitted with gas and air regulators; and there is no question as to the excellence of the illuminating power. It is known as the "Nico" 300-candle power indoor lamp; and a high efficiency per cubic foot is claimed. If preferred, the outer globe and inner cylinder can be replaced by a small bulb, with six air apertures in it. In this form, it has a remarkable resemblance to a small enclosed arc lamp. To say that it is both neat and nice is to do the lamp bare justice.

The "Nico-Reflex" Lamp.

There is no question that the gas industry must keep fully apace with, or in front of, the electrical industry, in meeting the claims for new forms of lighting, and forms that strike one as being consistent with the tendencies and improved knowledge of the times.

With due regard for eye comfort, we shall for the future be largely dealing with illumination rather than with direct lighting. The electrical industry has done much in this way. It is cultivating a fashion, which the gas industry originally introduced, but did not then follow, though it must do so now, notwithstanding that the same necessity does not exist with the low intrinsic brilliancy gas-lights as with the high intrinsic brilliancy electric lights. The new method of illumination which the gas industry should foster as much as possible is the semi-indirect; for by it no one can tell, except those who are able to correctly state the source of light by its quality, and those who have to pay the bills, whether gas or electricity is being used. The "Nico-Reflex" lamp is the one illustrated on p. 756.

The burners cannot be seen; and the illumination is derived from the light that is reflected from the large, white cone, and from the light thrown up to the ceiling by the bowl, and then reflected downwards, as well as from the light that passes through the translucent bowl. The lamp is constructed with three concealed burners, governed by one gas-regulator and one air-adjuster; and the mixture is fed into a special mixing-chamber, to which the three burner tubes and mantle supports are attached. The glass dish is supported on a sliding-rod. When in position, it is held up by a thumb-screw, by loosening which the rod with the glass bowl can be lowered, and so access is obtained for the cleaning of the lamp parts as well as for the replacement of mantles. The mantles are surrounded by a glass cylinder, which prevents the products of combustion coming into contact with the white surface of the conical deflector. The candle power is stated at 250; but with these things we shall have to begin to quote efficiency in terms of illumination, or candle-feet, as the candle power is altogether misleading. This is said for this reason: The candle power is a stationary quantity under certain conditions, whether the lamps are fitted with the reflecting parts, or light is obtained direct from the incandescent mantles. There is no illusion in this: When the lamp is fixed up with the bowl in proper position, there is a good diffusion of soft light about the place; when the dish is lowered so that its reflecting power is lost, and light is coming direct from the mantles, there is distinct loss of illumination of the surroundings. Anyone can see this for himself by an inspection of the lamps at the Company's show rooms; and such lights as these are, unless we are much mistaken, going to have for their intrinsic value a large adoption. Light obtained in this way is not trying to the eyes; and there is a total absence of glare. Moreover, with such semi-indirect lighting, the economy over electrical illumination is much more marked.

In the show-rooms, there are noticed other attractive fittings on the semi-indirect principle. These are fitted with three burners governed by a separate bye-pass; so that one, two, or three of the burners can be used at will, and according to requirement. The gas and air adjustments are all outside the metal band supporting the glass bowls; but they are so secreted within ornaments that they are not seen. Again the light is beautifully soft, and well diffused. These fittings will be seen at the National Gas Exhibition; and we believe that from the time of the display, there will be a fillip given to the semi-indirct system with gas-burners as the source of illumination.

PLAIN AND ORNAMENTAL CASED GAS-FIRES.

Messrs. Fletcher, Russell, and Co.'s New Productions.

THERE are broadly two types of gas-fires required in these times. There are the high efficiency, plain-cased fires, the parts of which (according to size) are interchangeable, and which are moderate in initial cost and in maintenance costs for letting on hire, for use in ordinary rooms and positions; and there are the fires that partake of the same efficiency characteristics, but have ornamental casings appropriate to rooms of superior architectural and decorative features. Messrs. Fletcher, Russell, and Co. (despite the busy times they have had at their works during the past year) have not neglected, in looking forward to the gas-fire season, the claims of modern requirement; and they are early in the field with information as to their new types of fires.

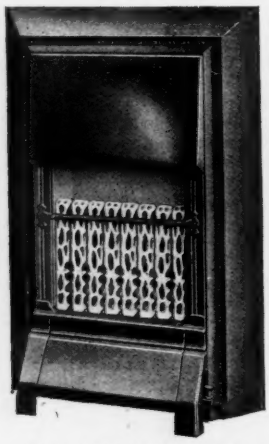
FIRES SUITABLE FOR HIRING-OUT.

As the largest demand in the growing popularity of the gas-fire is for the ordinary patterns, attention may first be directed to the new plain-cased fires. These are an adaptation of the

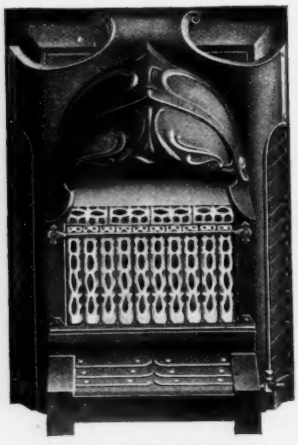
THE "BORNEO" SERIES OF PLAIN FIRES FOR HIRING-OUT PURPOSES.

"Borneo" and "Palermo" series of fires; and through them, as in the case of other fires, the firm show that they are maintaining their position in the front rank of producers. Each series comprises 8-inch, 10-inch, 13-inch, and 16-inch fire widths; and, in the four sizes, there is found the heating capacity requisite for any ordinary-sized room. It will be conceded, from the photographic reproductions, that the fires make a very suitable set for simple hire. The parts are interchangeable, size for size. The burners in them are of the type for which the firm have deservedly maintained a high reputation; and they are fitted with the necessary adjustment to secure complete combustion under the varying conditions of gas supply in different localities. The fuel (in the appearance of which the firm have made a noticeable advance) is retained in position by a single bar. Previously in their fires, the firm have not always adhered to the top horizontal row of fuel; but they have now reverted to the practice, finding that the top

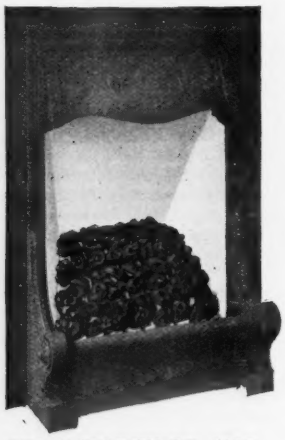
THE "PALERMO" SERIES OF PLAIN FIRES FOR HIRING-OUT PURPOSES.



THE "ROSARIO" FIRE.



THE "HERO" FIRE.



THE "GROSVENOR" FIRE.

line does act as a baffle, and so contributes to heating efficiency. In regard to the casings, it will be observed that, while plain, they have a good appearance, and offer no harbourage for the accumulation of dust. Another point is that (except in the smallest size of both of the series) the fires are fitted with, as depicted in one of each of the "Borneo" and "Palermo" fires in the illustrations, a self-supporting trivet, which, when not in use, can be closed down, and so is not in evidence. Right-hand or left-hand connections are arranged as desired. In these fires, the firm have made a marked advance.

Quite a new pattern is the "Rosario" fire. This is also a good-looking design, in plain casing, and has all the merits in respect of interchangeability of parts and efficiency of the fires just noticed. Being an entirely new pattern, it is only made at present with the 10-inch wide fire; the reason being that the 10-inch width of fire is in greatest demand for hiring-out purposes, and for all ordinary rooms. If a 10-inch pattern of a particular fire gains favour, then the makers are fortified in deciding to extend this particular pattern into other sizes.

A companion design [not illustrated] to the one just noticed is found in a new fire named the "Faro." It is also 10 inches wide, and possesses the same attributes as the "Rosario." A distinctive feature about the "Faro," however, is that the canopy is well raised from the top of the fuel, but has a larger projection, but still not obtrusively large.

Correct Art in Gas-Fire Design.

In altogether different category from the former is the "Hero" fire. This is a fire not for hiring, but for selling. The design of the casing is a perfect study. In richly decorated rooms, or in rooms of special architectural feature, gas-fires are wanted with casings in the design of which pure art is found. There have been designs for this purpose that have been good, bad, or indifferent. There have been designs in which there has been a perfect medley of character; there have been designs in which the designer has endeavoured to get artistic effect by merely a blending of a few straight and curved lines. Such things are, in the eyes of the true artist, something to be abhorred. He wants genuine, not fictitious, character. Messrs. Fletcher, Russell, and Co. have jumped the fence between incorrect and correct art. They engaged an eminent sculptor to design the casing for the "Hero" fire; and the design bears critical examination, from which it issues with the endorsement of "excellent" upon it. Look into it, and it is seen that the canopy is in the form of a helmet; and the ornamentation at the sides and bottom of the casing represents the greaves in ancient armour. Every line and every curve is in keeping with the basic idea of the designer. Setting in a room a gas-fire of such correct design in pure art is to place in it something which forms a centre piece, and in which the most critical artist will find nothing to offend. It shows the difference between art and imitation in art. If architects and others have before them fires of this character, they will not hesitate to recommend them for positions from which gas-fires of less merit in design would be barred. For effect, the best finishes for the "Hero" fire are steel or armour bright. The fire width is 13 inches, because it is intended for large rooms and halls in high-class houses. Of course, from a gas supplier's point of view, a less ornamental fire will bring him as much business as a fire of this description; but fires such as this are requisite to open up business connections for gas heating in rooms where the plainer types might not be tolerated. The fire will be found among those used in the furnishing of the National Gas Exhibition.

Adapting Ordinary Fire-Grates to Gas Heating.

From the old crude form of utilizing ordinary grates for gas heating we have long since passed. In this line of work, Messrs. Fletcher, Russell, and Co. also call attention to one or two new features. To describe these, it is necessary to refer first to the firm's "Jet" burner fire. The grate burner employed is patented; and it is claimed for it that "it is the only burner of its type which gives a complete incandescent fire from the bottom to the top of the fire-bars." It removes "entirely from view the 2 inches or more of black iron which has usually appeared at the lower part of the bar, supplying instead a full-size fire at a lower gas consumption." In order to secure these results, the burner is provided with a number of finger jets, so spaced as to allow one column of pillar fuel to be placed over each. This row of fuel comes right down to the bottom of the grate, and over the jets, so completely hiding the burner from view. Then a second row of square fuel is packed crosswise, between the front row of fuel and the back brick, and a finish is made by layers of fuel on top of these rows, and over the back brick. Fitted with the firm's patent non-lighting-back arrangement, the fire can be turned very low without any possibility of firing-back. The burner is also fitted with gas and air adjusters, outside the user's view, but easily accessible to the fitter without removing the burner from the grate. By a simple arrangement of the finger jets, the fire is suitable for grates with curved, straight, or any form of fire-bars.

This brings us to the new "Grosvenor" fire, which is an extension of the idea of the older "Jet" fire, which on its own part has been very successful. The "Grosvenor" is intended to meet rather a new condition of things and different forms of grate, to satisfy both architects and householders. The idea is shown by the illustration of the fire in a low barless grate supposed to be already in existence. The firm simply supply the patent "Jet" burner (with curved fingers), the brick, and fuel. The brick rests on the curved burner, and is arranged at an angle. Lying on this are long rows of fuel, and on top of these is sprinkled a new "cinder" fuel to give the appearance of a coal fire. The angle at which the fire is made supplies a large incandescent surface, and, the firm contend, a better appearance than a fire of the kind that is made too flat. It is not claimed that the same heating efficiency is secured as from an ordinary gas-fire. But the fire has a good efficiency for its type; and for this the firm give chief credit to the "Jet" burner. The fire is made in three sizes to suit grates 14, 16, and 18 inches wide.

There is a further extension of this idea in the "Mayfair" fire. But there is no pretence to this being a coal fire. The fuel is placed perpendicularly up the front with a single bar; and there is a specially finished top to the fuel. Essentially an architect's fire, it is only intended for high-class property.

This information as to the lines along which Messrs. Fletcher, Russell, and Co. have been working for the coming heating season shows that there is no standing still in the production of types of gas-fires to meet current requirements, which are ever spreading and rising.

The power at the works of Messrs. Kenrick and Jefferson, Limited, of West Bromwich, has just been increased from 66 to 140 B.H.P. by the installation of a new twin-cylinder gas-engine, which embraces all the most modern improvements. It is what is known as a high-speed balanced engine, with variable admission and electric ignition. Provision is made for forced lubrication of all parts; and it is fitted with all the latest water-cooling appliances. It is started by means of compressed air, and has duplicate starters; while the exhaust is provided with patent silencers which practically abolish all noise in working. The shafting and dynamo are driven by a pair of the finest endless leather belts obtainable.

It is stated by our American contemporary "The Gas Age" that in 1912 the bye-product coke plants of that country made 11,048,489 tons of coke, 40 to 50 million cubic feet of gas per day for city use, and large quantities of tar and ammonia. Cities deriving from these ovens a considerable portion of the gas they consume are Boston, Camden, Indianapolis, Hamilton, Baltimore, Duluth, South Chicago, Milwaukee, Muncie, and Waukegan. The industry has developed during twenty years, until one-fourth of the coke made comes from bye-product ovens. The tonnage carbonized per man employed is nine times as great as it was a score of years ago, due to improved methods. The size of oven itself has doubled. The bye-product industry is of consequence, it is added, and its future trend will have a strong influence upon gas supply.

THE BRITISH ASSOCIATION GASEOUS EXPLOSIONS COMMITTEE.

Note on their Proceedings for the Year 1912-13.

Before Section G of the British Association there was submitted (but not discussed) the following interim report of the Committee appointed for the investigation of gaseous explosions, with special reference to temperature. The Committee consists of Sir W. H. Preece (Chairman), Mr. Dugald Clerk (Vice-Chairman), Professor W. E. Dalby (Secretary), Professors Bone, Burstall, Callendar, Coker, and Dixon, Drs. Glazebrook and Harker, Lieut.-Colonel Holden, Professors B. Hopkinson and Petavel, Captain Sankey, Professors Smithells and Watson, Mr. D. L. Chapman, and Mr. H. E. Wimperis.

At the Dundee meeting, certain changes were made in the constitution of the Committee. Sir William Preece continues to be Chairman; but Mr. Dugald Clerk and Professor Hopkinson resigned the joint secretaryship. Mr. Dugald Clerk, however, consented, to the great satisfaction of the Committee, to act as Vice-President, and Professor Dalby was appointed Secretary.

The Committee allocated the whole of the grant to the Secretary, with the object of providing him with a permanent research assistant to carry on the work. The moment is very favourable for this action of the Committee. The new laboratories of the Imperial College of Science and Technology are approaching completion; and it is intended by the governing authority of the college that these laboratories shall be devoted to research. Professor Dalby is working on a scheme with Mr. Dugald Clerk for equipping one bay with internal-combustion engines. It is recognized that the Imperial College would be materially assisted in carrying out their ideals if the work of the Committee were concentrated in the new laboratories.

Owing to a delay in the completion of the laboratories, it is not possible to present a report this year. Work, however, has been carried on with the old plant by Professor Dalby with the aid of a research scholar, and some important results have been obtained, which will be communicated in due course. The general work of the Committee has also gone steadily on during the year.

Three meetings have been held at the City and Guilds (Engineering) College, at which the following "Notes" were presented and discussed:—

Note 26.—"The flow of heat from a charge of air subject to cyclical variations of state in the cylinder of a gas-engine," and "The comparison of the temperature readings of a platinum thermometer with the temperature computed from the pressure volume diagram." By Professor Dalby.

Note 27.—"The flow of heat between a charge of air enclosed in a gas-engine cylinder and the walls of the cylinder when the charge is subjected to a cyclical variation of temperature." By Professor Dalby.

Note 28.—"Leakage of charge." By Professor Dalby.

Note 29.—"Gas-engine temperatures." By Professor Hopkinson.

Note 30.—"The effect of compression ratio on the efficiency of a gas-engine." By Professors G. Asakawa and J. E. Petavel.

Note 31.—"Determination of leakage by the method of alternate compression and expansion." By Mr. Dugald Clerk.

Note 26.—In this note, which was presented last year, Professor Dalby drew attention to a method of testing and correcting for leakage in a gas-engine cylinder. A detailed explanation of this method was given in the note, which was accompanied by eight photographic records relating to the experiments referred to. These were carried out at one constant speed. The observations were made by two research students of the Imperial College—Messrs. Mawson and Begg—working under the direction of Professor Dalby.

Note 27.—This note is a record of the results obtained by applying the method to the same engine run at different speeds, in order to ascertain the effect of speed on the leakage. The paper was accompanied by eleven large blue prints giving the data and the deduction drawn from them.

Note 28.—There was considerable discussion at the Committee regarding the amount of leakage found; and at the request of the Committee, Professor Dalby made some further experiments, the results of which are embodied under Note 28. This note was accompanied by a blue print of two curves and a photographic record.

Note 29.—Professor Hopkinson's note consisted of general remarks relating to the importance of knowing the suction temperature and its influence on the heat flow.

Note 30.—This note relates to the efficiency of a gas-engine with varying degrees of compression. It is embodied in a paper to be presented at this year's meeting of the Association [see next column].

Note 31.—This note, presented by Mr. Dugald Clerk, relates to experiments on the determination of the specific heat of gases, with special relation to the correction applied to eliminate the effect of the small amount of leak of charge.

EFFECT OF COMPRESSION RATIO ON THE EFFICIENCY OF A GAS-ENGINE.

The following note by Professor G. Asakawa and Mr. J. E. Petavel was presented to Section G (Engineering) of the British Association last Thursday. It may be taken as supplementary to the report of the Gaseous Explosions Committee [see previous column].

The experiments were carried out on a 25-horse power gas-engine working at normal speed. The load, speed, and number of missed explosions were kept constant, while the ratio of compression was varied by altering the length of the connecting rod. Coal gas was used; its calorific value being determined both by analysis and by direct measurement. The heat carried away by the jacket water and by the exhaust gases was carefully measured, and a heat-balance established. The results may be summarized as follows.

The brake-horse-power at full power increases in the same proportion as the theoretical air efficiency; so that the ratio of the two, or the relative efficiency, remains constant at about 55 per cent. Under light loads, the increase of frictional losses with high compression ratios nearly counterbalances the gain in thermodynamic efficiency; and hence, while the absolute efficiency remains constant, the relative efficiency falls. At all loads, the mechanical efficiency is higher for low compression ratios. At full loads, it fell from 79 to 74 per cent., as the compression ratio rose 3·7 to 5·6; at one-quarter load it fell from 54 to 50 per cent. for the same change of compression ratio.

The indicator power at full load increases at a higher rate than would be indicated by the air standard, and at light loads at the same rate. Hence the relative indicated efficiency increases at full loads and remains constant at light loads. Using gas of a lower calorific value of 520 B.Th.U. per cubic foot at 32° Fahr., the consumption at full power was 21 cubic feet per brake-horse-power per hour with the lowest compression; and 19 cubic feet with the highest. Full numerical data, together with a discussion of the results, will shortly be published.

GAS MANUFACTURE IN RELATION TO THE DISPOSAL OF THE BYE-PRODUCTS.

A paper on this question which was read by Herr Frankenfeld at a meeting of the Posen Local Section of the Association of German Engineers is published in the official organ of the Association—the "Zeitschrift des Vereines Deutscher Ingenieure" of the 6th inst. The following notes on points of special interest are taken from the paper.

Gas coals are coals which are rich in hydrogen relatively to the oxygen they contain. Hydrogen in excess of that required to combine with the oxygen to form water goes, when the coal is distilled, to form with the carbon of the coal volatile hydrocarbons. This surplus or available hydrogen is, according to the author, found to be higher in certain of the Westphalian gas coals than in English gas coal.

The carbonizing plant at the Posen Gas-Works now consists of ten settings, each containing nine inclined retorts, 18 feet in length. The Posen gas coke contains 80·04 per cent. of carbon; 1·29 of hydrogen; 2·46 of oxygen; 0·48 of sulphur; 4·66 of water; 11·07 of ash. It has a calorific power of 12,095 B.Th.U. per lb.; and its temperature of ignition is 1290° Fahr.

The author gives a heat-balance which shows that of the total calorific power of the coal carbonized, the products of gas manufacture contain the following percentages: Coke, 62·1; tar, 8·9; gas, 25·6; unaccounted for, 3·4.

In referring to tar products, the author states that the cost of the fuel, when naphthalene is used in an engine for the production of power is only one-third of a penny per horse-power-hour. A recently introduced manufacture of considerable importance is that of resin-like bodies, known as Bakelite and Resinite, from phenol and cresol. These bodies are finding application in many industries. In the year 1912 about 1½ million tons of coal tar were produced in Germany. Of the coke-ovens in that country 93 per cent. were equipped with bye-product recovery plant.

Swiss Association of Gas and Water Engineers.

The programme of the fortieth annual general meeting of this Association, which was held at Berne on the 6th to the 9th inst., included the reading and discussion of the following papers: "Notes on the Gas-Works and Water Supply of Berne," by the Manager, Herr W. Kuhn; "The Fusion Points of the Ash of Coals," by Dr. E. Constam, Professor at Zürich; "The New Lake Water-Works of the City of Zürich," by the Manager, Herr H. Peter; and "Flameless Surface Combustion and its Importance to the Gas Industry," by Herr R. Blum, of Berlin. Visits were paid to the local gas-works; and the last day was devoted to an excursion, in the course of which various places of interest in connection with water supply were inspected.

NEW SHOW-ROOMS AND OFFICES AT STAFFORD.

Modernizing and Utilizing an Interesting Building.

We have received from Mr. W. M. Valon, the Gas Engineer and Manager of the Stafford Corporation, some particulars and views of the new show-rooms which have lately been opened in the centre of the town. They bear testimony to his thorough belief in the value of such a medium for bringing before the residents the great advantages of gas, and consequently adding to the revenue of the gas undertaking.

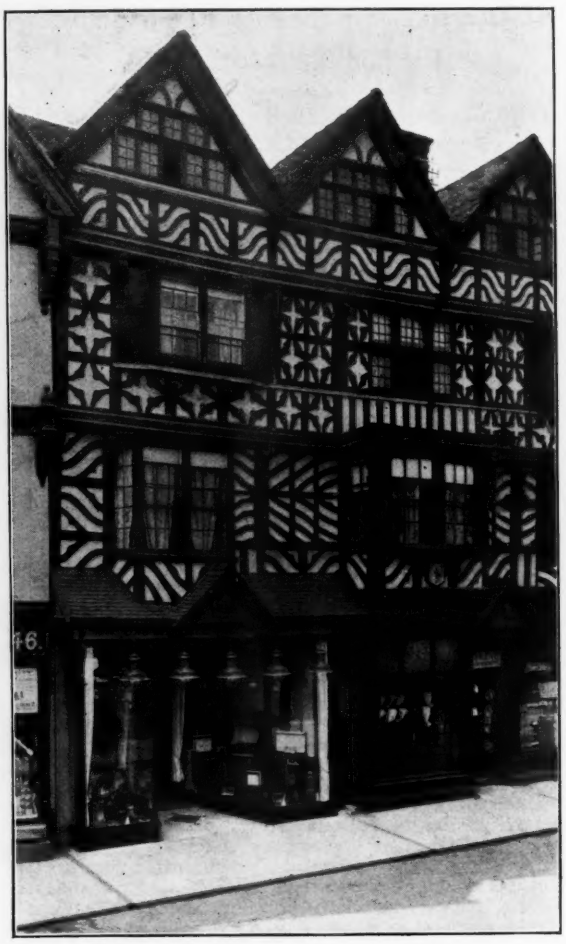
When Mr. Valon entered upon his duties in 1910, the only show-room was a small one, measuring 20 ft. by 10 ft., at the gas-works; and in order to reach it a visitor had to go into the works, pass through the fittings shops, and ascend a flight of stairs. Though this room served its purpose in a small way, it was obvious that the best class of consumers would not visit it; in fact, most of them did not know of its existence. Having had some previous experience of show-rooms, Mr. Valon was quite convinced of their necessity and value; and though his Committee were at first of opinion that the room at the gas-works was all that was required, he eventually obtained their permission to open a small one in the town, in conjunction with the Cannon Iron Foundries, Limited, and commence canvassing. The result was that in six months he put out 500 new cookers, and did a considerable trade in gas-fittings. With all this experience to lay before his Committee, he was able to convince them that his ideas as to show-rooms were correct.

After many months' search for suitable rooms, a shop was obtained in the very centre of the town, and in one of its oldest and best-known buildings; and, being of considerable size, he was able at the same time to form the back part into business premises. The building is called "The Ancient High House," and it is shown on the accompaning illustration. As will be seen, it is a half-timbered edifice erected in 1555, and on the gable end is a tablet on which appears the following wording:—

> That House was erected in the year 1555 by Robert Dorrington, Esquire, of Stafford. In 1642, King Charles the 1st and Prince Rupert visited this ancient Borough, and stayed here from Wednesday 17th to Friday 19th September as guests of Captain Robert Sneyd.

Another interesting feature is that Izaak Walton was born in the building; and over the centre of the doorway is a plaster cast of his head commemorating this event. Above the doorway of the next shop there is another plaster cast in memory of the visit of King Charles.

About the year 1840, the premises ceased to be used as a private house and were converted into shops; and when the Gas Committee took possession the original windows were in. The first difficulty met with was to put in a shop-front suitable to the building; and this Mr. Valon was able to do. He then had to gut the whole of the inside of the premises, owing to the fact that they contained two chimneys, one 20 feet square and the other 15 feet, both rising from the bottom through the whole of the storeys, and having part of the floors built into them. These having been removed, there was left plenty of space at disposal; and therefore the front portion was left as a show-room and the back portion as the counting-house. Consequently all consumers, when paying their accounts, have to pass through the show-room, and therefore cannot help seeing something of the goods displayed there. The top portion of the premises not being required at present by the Gas Committee for their own purposes, they have had them fitted up as bedrooms, &c., and have rented them to the



The Stafford Corporation Gas Show-Rooms.

AN INTERIOR OF THE STAFFORD CORPORATION GAS SHOW-ROOM.

ANOTHER VIEW IN THE SHOW-ROOMS.

proprietors of the Swan Hotel, which adjoins the building. These show-rooms have been open about three months, and are giving every satisfaction; the cash sales weekly being sufficient to pay the whole of the rent.

WORKING RESULTS OF THE WOODALL-DUCKHAM RETORTS AT BUDAPEST.

THE following is an abstract translation of a paper read by Herr J. Bernauer, of Budapest, at this year's meeting, in Vienna, of the Association of Gas and Water Engineers of Austria-Hungary. The paper was published in full in the "Zeitschrift des Vereines der Gas und Wasserfachmänner in Oesterreich-Ungarn" of the 15th of June; and a discussion which followed the reading of the paper was given in one of the succeeding issues of the same paper.

The new large gas-works for Budapest at Obuda (Alt-Ofen or Old Buda) will come into operation this autumn; and the old works at Józsefáros (Joseph's Town), Buda, and Ujpest (Neu-Pest or New Pest), will then be demolished, while the two gas-works at Ferencváros (Francis Town) will be retained, but will be equipped with modern plant. The older of these two works has horizontal retort-settings for manual labour; while the other works has inclined retort-settings. Since the working of such settings is not economical, the reconstruction of both works is contemplated in the immediate future.

The exhaustive inquiry which has been undertaken in regard to the construction of the Alt-Ofen or Obuda works has led to the conclusion that, in the conditions prevailing locally, the most economical carbonizing system will be horizontal carbonizing chambers or ovens heated with producer gas. This works is, therefore, being equipped with such settings. In the Ferencváros works, on the other hand, the conditions are different; and large carbonizing chambers could scarcely be used. The size and shape of the site and the disposition of the existing buildings and apparatus, as well as the fact that the works stand in a closely populated part of the town, necessitated the adoption of settings which required comparatively little ground space, and the working of which produced as little smoke and steam as possible. Hence, at the present time, vertical retorts were indicated as most suitable; and, having regard to the avoidance of smoke and steam, retorts with continuous and automatic charging seemed desirable. Data were available as to the carbonization of coal such as is used in Budapest—both in Dessau vertical retorts, and in Pintsch-Bolz retorts (at Agram); but no such data were available as to the carbonization of such coal in continuous vertical retorts.

The conviction was formed after visits to England, that the efforts of English gas engineers (pursued with great persistence for more than ten years) to introduce retorts with continuous automatic charging and discharging had been so successful that an experimental installation on one of these systems might reasonably be put in. The indifferent results of the Woodall-Duckham settings at Lausanne did not alter this view, because an exhaustive study of the improved Woodall-Duckham settings at Luton led to the conviction that the fault which occurred in the Lausanne settings had been eliminated, and the working of the settings had become free from objection. The extended use of both the Glover-West and the Woodall-Duckham systems during the last two years—not only in England but also abroad—indicated that these systems had become perfected and that their advantages were now being appreciated.

The author briefly enumerates these advantages as follows: The carbonizing chamber is not opened in working, either for charging or discharging; and the coke is discharged in a cool condition. There is no evolution of steam and smoke in working; consequently, there is no annoyance therefrom to either the staff or people in the neighbourhood. The Woodall-Duckham and the Glover-West systems are alike in general principle, but differ in the details of the charging and discharging mechanism, and in the construction of the carbonizing chambers or retorts. The Woodall-Duckham retorts are considerably larger, and therefore the passage of the coal through the retort is facilitated, and a greater productive capacity is secured on the same ground area. The Woodall-Duckham retorts are 25 feet high, and taper upwards; the cross-section at the lower end being 63 in. by 20 in., and at the upper end 48 in. by 8 in. The fire-bricks of which the retorts are constructed are grooved and tongued, in order to make sound walls. There are four retorts in one setting, heated by a producer which is built in between the retorts. Six settings may be erected in one bench with a single chimney. The producer has a grate which is partly stepped and partly plane; the step-grate being constantly sprinkled with water. Beneath the plane-grate is a water-pan. Openings controlled by valves regulate the supply of primary air to the producer. The retorts are heated chiefly in the upper third of their length; burners being arranged there on the wider sides of the retorts. The temperature in this part of the chambers reaches a maximum of 2370° to 2410° Fahr. The heat of the fuel is very well utilized, owing to the producer being built in between the retorts and to the great height of the settings and resultant great length of the recuperation flues. Thus the fuel consumption is low.

The author proceeds to describe the charging and discharging arrangements of the Woodall-Duckham settings. He mentions that the coke is discharged so that it is just warm to the hands—viz., at 105° to 120° Fahr., and is almost completely dry. As a rule, it does not contain more than 1 to 2 per cent. of moisture, and has a good appearance—being silver white, glossy, very porous, and light. It is mostly large, and does not contain more dust and breeze than the coke from the inclined retorts at Buda-

pest. It is particularly well adapted for heating rooms, which is the purpose for which the best price is obtained in Budapest.

Two settings in one bench have been erected at the No. 2 Ferencváros works in Budapest in an annex to the existing retort-house. They have been in uninterrupted working since the 16th of October last year. The retorts have to be scurfed once in six to eight weeks. The scurf occurs mostly in the highly heated upper third of the retorts, and is removed by blowing steam in for eight to ten hours. So far, the settings have behaved very well. There are no distortions or cracks in either the retorts, the heating flues, or the masonry. The service of the settings requires in each shift two men at the coal and coke elevators, one man as overseer or foreman, and two men for discharging and removing the coke. These five men also look after the clinkering of the producers. The same staff could, however, attend to five or six such settings without any difficulty. There are in the old works settings of horizontal retorts and settings of inclined retorts; and the author gives in Table I. a direct comparison of the ground area, the number of men required, and the wages for the same productive capacity with the three different types of settings.

TABLE I.

Comparison of Different Types of Settings at Budapest.

Productive Capacity per 24 Hour.	425,000 Cubic Feet.			1,275,000 Cubic Feet.	
Type of Setting.	Area of Retort-House.	Labour Required (Two Shifts).	Wages per 1000 Cub. Ft. of Gas Made.	Labour Required (Two Shifts).	Wages per 1000 Cub. Ft. of Gas Made.
	Sq Ft.	Men.	Pence.	Men.	Pence.
Horizontal retorts	5167	2 × 18	4·3	2 × 50	3·7
Inclined retorts	3444	2 × 12	2·8	2 × 28	2·3
Woodall-Duckham retorts .	1722	2 × 5	1·1	2 × 5	0·4

Table I. shows that the ground space required for Woodall-Duckham settings is only one-half or one-third of that required for inclined or horizontal settings. The inclined or horizontal settings require five or ten times the number of men to work them. These figures are based on actual working conditions, and are not mere fanciful figures. The comparatively high wages with the inclined retorts are due to the latter being only 13 feet in length, and the coke being quenched and removed by manual labour.

The delivery trials of the Woodall-Duckham retort-settings were made from the 16th to the 19th of May last. The coal carbonized and the coke obtained, as well as the coke used for fuel were exactly weighed. Calorimetric tests and analyses of the gas were made throughout. The results of the trials are summarized in Table II. In regard to the calorific power of the gas, the figure given is the average of about a hundred determinations;

TABLE II.

Results of Four Days' Trial of Two Woodall-Duckham Settings each of Four Retorts, with Dombrau (Austro-Silesian) Coal—Large and Cobbles.

Composition of coal—	Moisture	3·72 per cent.
	Ash	7·17 ,,
	Combustible matter	89·11 ,,
Coal carbonized per 24 hours		33·63 tons.
,, ,, ,, per retort		4·20 ,,
Gas made per 24 hours. Cubic feet at 60° F. and 30 ins.		411,391
,, per retort per 24 hours ,, ,, ,,		51,420
Gas made per ton of coal ,, ,, ,,		12,222
,, ,, combustible matter of coal ,,		13,725
Gross calorific power of gas. B.Th.U. per cub. ft. at 60° F.		557
Net ,, ,, ,, ,,		497
Valuation figure—B.Th.U. in gas from 1 ton of combustible matter of coal		7,644,825
Composition of Gas—	Carbonic acid	2·9 per cent.
	Heavy hydrocarbons	2·8 ,,
	Oxygen	0·5 ,,
	Carbonic oxide	8·6 ,,
	Methane	30·17 ,,
	Hydrogen	49·76 ,,
	Nitrogen (by difference)	5·27 ,,
		100·00
	,, (by direct determination)	4·90 ,,
Specific gravity of gas		0·484
Coke made in 24 hours		24·06 tons
,, ,, per cent. by weight of coal carbonized		71·58
Composition of the coke	Moisture	2·02 per cent.
	Ash	9·45 ,,
	Combustible matter	88·53 ,,
Size of coke	Large (above 2 inch)	75·94 ,,
	Medium (1 to 2 inch)	14·66 ,,
	Small (⅝ to 1 inch)	1·29 ,,
	Breeze (less than ⅝ inch)	8·11 ,,
Coke used in heating the retorts; per cent. by weight of coal carbonized		11·48
Coke used in heating the retorts; lbs. per 1000 cubic feet of gas made		19·81
Composition of coke used in heating the retorts	Moisture	3·47 per cent.
	Ash	10·52 ,,
	Combustible matter	86·01 ,,

the lowest result obtained for the gross calorific power being 526 B.Th.U., the highest 585 B.Th.U. per cubic foot at 60° Fahr., 30 in., and saturated. The fluctuations in the calorific power of the gas are, therefore, considerably smaller than with other carbonizing processes. The coke used as fuel was large coke lifted by forks; and it amounted to 11·48 per cent. by weight of the coal carbonized.

DISCUSSION.

Herr ANZBÖCK, who was in the chair, having declared the discussion of Herr Bernauer's paper open,

Dr. OTT, the Chemist at the Zürich Gas-Works, spoke to the following effect: The development of Woodall-Duckham settings had especial interest for Switzerland, because the first of these settings on the Continent was in Lausanne, and, as Herr Bernauer had pointed out, they had given very indifferent results. It might well be that the enlarged carbonizing vessels which had been adopted experimentally in the Budapest installation would give better results. The speaker would, however, like to ask Herr Bernauer if he had never had any stoppages. He (Dr. Ott) had examined these settings in England, and had often noticed blockages even with the largest patterns. Commonly, they depended on the coal; and it might be that the Dombrau coal used in Budapest gasified comparatively easily. French coals, on the other hand, gasified with some difficulty; and if blockages resulted, the charge had to be pricked either from above or below, and the much-talked-of hygienic advantages of the system then disappeared. It became not only directly unhygienic for the workmen, but more or less dangerous. This depended, however, on the coal, and he did not think one ought to generalize too much from such trials with an experimental setting. As to the quality of the coke, much depended on whether the purchasers desired large and dense, or small and porous, coke. In England large coke was not asked for, whereas it was preferred on the Continent, where there was more central heating.

Herr FAEHNDRICH, of Dessau, asked whether the leakages at the valves or dampers, which occurred at Lausanne, had been avoided in the Budapest settings, and also how the scurfing was carried out.

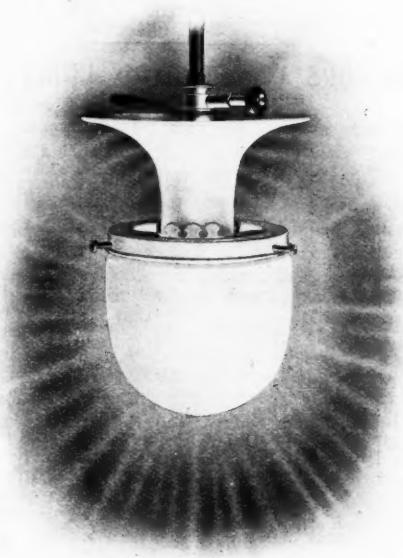
Herr BERNAUER replied to Dr. Ott's question in regard to blockages, that at the start they were told that the retorts should be scurfed once every four weeks. This was done by stopping the supply of coal, and removing the coke completely from the retort by heating the setting more highly and discharging the coke through the lower opening. A steam jet was then introduced through the opening provided for the purpose at the upper end of the retort; and steam was injected into the retort for six to eight hours. The scurf occurs only in the upper third of the retort, and chiefly at the corners. It falls away in large lumps, and but trifling work is required to clear it entirely from the retort. Very little scurf was found in the retorts the first time they were opened for scurfing; and consequently the scurfing was then done at intervals of six weeks, and there had been no sticking of the charge. They had later been run for eight weeks without scurfing; and at the end of this time the column of coal stuck in one of the retorts. It was set free by pricking; and the retort was then scurfed. Since this experience, the scurfing had been done at intervals of six weeks; and no further sticking of the coal had occurred. As to the quality of the coke, about 90 per cent. of it was large and medium sized. The coke was not so hard and large as that from large carbonizing chambers or ovens and Dessau vertical retorts. In Budapest, however, a better price was always obtainable for the smaller coke, as the greater part of it was used for heating rooms. The smaller coke being in better demand, less breaking was required with the Woodall-Duckham coke. As to the soundness of the dampers or valves, which gave great trouble in Lausanne, the coal there was fed in automatically; the circular disc-valves being in constant rotation. Consequently, the faced surfaces of these valves had become roughened by coal dust, and soon became unsound. At Budapest, the valves were not kept continuously in rotation, but were opened and closed by a workman every two hours. No noticeable wear had occurred with them. The settings had been uninterruptedly worked for seven months, and no unsoundness of the valves had arisen.

Herr BUEB, of Berlin, said that it might be interesting, in view of the comparisons made with other settings to give results for recent installations of Dessau vertical retorts in which the units were large and the heating had been improved. The staff of the Carlsruhe Experimental Gas-Works had carried out six to nine day trials on three installations of Dessau retorts, using German coals, and the Budapest authorities made trials in Berlin with Dombrau coal. The results were: At Pforzheim, a make per ton of German coal of 14,245 cubic feet of gas, having a gross calorific power of 556 B.Th.U. per cubic foot. The coke consumed as fuel was 12·8 per cent. by weight of the coal carbonized. (2) At Mannheim, the make per ton was 13,510 cubic feet; the calorific power 602 B.Th.U. per cubic foot; the fuel consumption 12·13 per cent. (3) At Mariendorf, Dombrau cobbles gave a make of 13,743 cubic feet per ton, with a calorific power of 546 B.Th.U. per cubic foot; Dombrau unscreened coal gave a make of 14,138 cubic feet of gas per ton, with a calorific power of 533 B.Th.U. per cubic foot; Concordia (Saxony) large coal gave a make of 14,245 cubic feet per ton with a calorific power of 558 B.Th.U. per ton, and a fuel consumption of 11·66 per cent.

The CHAIRMAN then proposed a vote of thanks to Herr Bernauer for his interesting paper, and it was duly agreed to.

THE "SOFTLITE" BURNER.

Aptly named, indeed, is a new inverted gas-light to which attention has been drawn by Messrs. Moffat, Ross, and Co., Limited, of No. 209, Upper Thames Street, E.C. It has been evolved specially to meet the large demand which is known to exist for a cheap, but efficient and thoroughly reliable, semi-indirect light; and an examination of a sample leads one to the conclusion that it is in every way well fitted to successfully accomplish its mission. More than this, the appearance of the fitting is quite in its favour. So far as shape is concerned, this will be gathered from



A New Lamp for Semi-Indirect Lighting.

the accompanying illustration. It is small and compact in design, and the opal bowl and reflector are attached by a white and gold lined gallery. Around the top of this gallery there is an open space through which the light passes to the reflector above. All improvements in the matters of air and gas adjustment, specially insulated regulators, dust-proof provision, non-discolorable parts, &c., will be found included in this new burner, which also has a magnesia nozzle, universal fitting.

The main features claimed for the lamp, however, are, as already remarked, those embraced in semi-indirect lighting—*i.e.*, entire absence of glare, perfect diffusion of rays, and mellow, soft, shadowless light which is evenly distributed over the area of illumination. There is no need to enumerate here the cases in which such a light is specially desirable. They are many; and the "Softlite" should do its share to meet them, where moderate units of light are desired.

WASTE OF AMMONIA.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

(*Concluded from p.* 616.)

A very general impression is that, on account of the high degree of solubility, all that need be done is to provide apparatus of large capacity in proportion to the make of gas, and the remainder will always take care of itself. What constitutes "large capacity" is a matter that is only guessed at. The makers of scrubbers and washers usually adopt a plan of sizing their apparatus in millions, or parts of a million, production per twenty-four hours; but their ideas are generally somewhat optimistic in character, and it is well to allow a liberal discount. If the maximum make is 500,000 cubic feet, the washer should be of the capacity rated at 750,000. I have no prejudice in favour of mechanical as compared with non-mechanical apparatus, having done efficient work with both kinds. It is more a question of cost, space available, and other practical considerations, than whether one system is more effective than the other in removing ammonia. Whatever the system used, it must, to be effective, get at every particle of the gas.

Sometimes an excessively large apparatus may be a delusion and a snare, and in practice quite as defective as one too small, because in any case so much depends on systematic working and attention. One man will do better and more effective work with a home-made apparatus than another would obtain from a set of the most costly and elaborate character. Periodical attention to cleanliness, temperature of gas and air, and a graduated adjustment of the strength of the liquor, from the strongest at the beginning down to practically clean water at the finish, are indispensable adjuncts to a satisfactory result. The gas should be thoroughly cooled and freed from tar before reaching the first scrubber, because it is not the province of the apparatus to give the finishing touch to the reduction of temperature or the extraction of tar-fog. Neglect of this point is responsible for the idea that excessive washing or scrubbing is bad for the gas. A sudden douche with a liquid 20° or more lower in temperature than the gas, or exposure to surfaces thickly coated with tar, may prejudice the photometrical value. But properly conducted washing and scrubbing to any reasonable extent not only removes all the ammonia, but a third or more of the carbonic acid—thus economizing lime where that material is freely used, or improving the photometrical value if oxide only is relied upon. Sometimes we find that the whole process of condensing and purifying, from the hydraulic to the holder, is merely a step or two in advance—one thing overlapping the other. The first washer or scrubber, apart from its legitimate function, has to complete the cooling of the gas and the removal of the tar. The second takes up, more or less ineffectively, the work that should have been done in the first. This, in its turn, leaves the purifiers, meter, and gasholder tank to complete the removal of the ammonia. It is not consistent to check the application of liquid in the washer or scrubber, and then to allow the gas to stand, perhaps for some days, in a gasholder where it is freely exposed to a surface of water equal in extent to the whole horizontal area of the vessel, or to pass the gas through wet meters.

While there is no special difficulty about the manipulation of a quantitative test of ammonia either in gas or in liquid, the operation, if worth doing at all, is worth doing carefully and accurately. The solutions must be pure, and of correct strength. The standard acid and alkaline solutions required can be obtained ready made; and the burettes, pipettes, and other graduated apparatus should be of the best quality, and bear the Kew certificate. When setting out upon a course of investigation, the results of which may figure in the accounts to the extent of hundreds or thousands sterling, or may extend over months and years, it is a great mistake not to be rigidly accurate and exact at the start. Failing this, at an advanced stage the annoying discovery may be made that a burette is inaccurate, or one of the solutions is not of correct strength, and that the value of the work already done is seriously impugned. Some judgment and general laboratory experience are necessary in order to suit the methods, quantities of solution used, and scale of operations to the quantity or proportion of ammonia to be dealt with. In the gas at the outlet of the last scrubber there should be only a mere trace; and the same applies, or should apply, to the effluent from the sulphate plant. In dealing with such minute quantities, there should be some modification in the strength of solutions, the quantity of gas passed, or of liquid used for the test. Hydrometer tests are useful for comparative purposes as a quick test of the work being done, but are in no sense reliable as quantitative tests of the percentage of ammonia in a liquid; and for the satisfactory determination of minute proportions, reasonably large quantities of gas or of liquid should be examined.

If one would know the exact position as to ammonia removal and utilization, it is necessary to determine the quantity of ammonia in the gas at the outlet of the hydraulic, and at the inlet to the purifiers. Or, on account of the practical difficulty of getting a reliable test on uncondensed hot gas, operations may not go farther back than the outlet of the condenser, in which case the total make of ammonia can be calculated from the annual make of liquor or of sulphate. The make of sulphate is a very reliable guide, provided one is satisfied that there is no waste of ammonia by way of the fume-pipe or the effluent. Tests may also occasionally be taken at the outlet of each scrubber or washer, so as to determine the part in the work that is borne by each piece of apparatus.

The tests on the liquor should not only include the accurate determination of the ammonia, both free and fixed, but periodical measurement and registration of the quantity of liquor in stock, and of the quantity disposed of either to the sulphate plant or the railway tank waggon. If the arrangements of the plant permit, it is well to know something about the quantity supplied to each piece of apparatus, and of the clean water added. This is fairly easy in the case of a washer; but the supply to the scrubber is, as a rule, of a very indefinite character. For every scrubber there must be a maximum limit, beyond which there is no advantage to be gained by increasing the supply of liquid; and I would venture the opinion that this limit is appreciably below the usual rate of supply. Provided the distributing apparatus is efficient, there is no valid reason why the supply to the scrubber should be the full bore of a 4-inch pipe, while that to a washer of similar capacity—that is, as regards quantity of gas to be dealt with—is 1-inch or less. The risk of loss of ammonia at the tip bucket, already alluded to, will bear some proportion to the total quantity of liquid passed.

Those who dispose of their ammoniacal liquor as such may leave off here. But as the majority have to consider pounds of sulphate rather than gallons of ammoniacal liquor, these remarks may be extended to the manufacture of sulphate. If the whole of the ammonia contained in the liquor is to make its way into the sulphate store, the fume-pipe from the saturator and the effluent from the still or boiler must be carefully watched. With a still on the Coffey pattern, of the best make, it is possible to bring the

ammonia down to a decimal point per cent.; but this cannot be done with a home-made affair consisting of an externally fired boiler. Wet steam—that is, steam blown direct into the liquid—displaces ammonia more readily than a closed steam coil or external firing.

Very crude ideas appear to prevail on the subject of the fixed ammonia. Some suppose the practical difficulties connected with the use of lime, or the expense of caustic soda, quite outset the gain secured by extracting all the fixed ammonia. Once I was assured that as good a yield was obtained without the use of fixed alkali as with it; and further inquiry elicited the fact that the fixed alkali, when used, consisted of 7 lbs. of caustic soda, to a charge of 1500 gallons of liquor, run in about thirty minutes before finishing the boil. There seems to be a general impression that a homœpathic dose of fixed alkali will take care of any amount of fixed ammonia. The fact is that fixed alkali will only displace its equivalent of ammonia; and in practice, even with the best apparatus and working, the quantity will be somewhat less. Thus 40 lbs. of chemically pure caustic soda, or 37 lbs. of chemically pure slacked lime, will not, under any circumstances, displace more than 17 lbs. of ammonia in the fixed condition. Neither soda nor lime will be obtained in commerce as anything like 100 per cent. pure. They will contain moisture and other extraneous matter. Commercial caustic soda, soda ash, or lime will be efficient in proportion to the percentage of pure alkali contained. A soda ash yielding on analysis 55 per cent. of NaHO will displace a maximum of $\frac{17 \times 55}{40 \times 100} = \frac{187}{800}$, or $\frac{800}{187}$ lb. will be required to displace 1 lb. of ammonia. It will, therefore, give in practice nearly its own weight of sulphate. A lime showing 85 per cent. of pure CaH_2O_2 will displace $\frac{289}{740}$ lb. of ammonia, or yield rather more than one-and-a-half times its weight of sulphate. As the proportion of fixed ammonia is frequently 20 per cent. of the whole, and the cost of the equivalent in lime or soda is considerably less than the net profit on the sulphate, it follows there must be an important loss if the whole of the fixed ammonia is not displaced. Lime is comparatively cheap, and therefore may be used freely; but on account of the price of soda, there is a tendency to be too economical with its use.

The fixed alkali will not fulfil its proper function unless it is brought into contact with every portion of the liquor. If a closed boiler is used, the boiling must be continued after the addition of the alkali for a sufficient time to ensure a sufficient mixing. The idea that fixed alkali does not appreciably increase the yield of sulphate is partly due to neglect in this respect; and if a continuous still is used, the supply of fixed alkali must also be continuous. It is no use to run in a charge every half-an-hour or so. Where there is no difficulty about disposing of the effluent, lime is the cheaper form of fixed alkali to use. But it gives a considerable bulk of mud or sludge in the effluent—necessitating the use of large settling tanks, if the effluent has to be clarified for use on the works, or before running off. Soda has the advantage of giving a clear liquid, not requiring filtering or settling tanks.

In these days of the bacterial treatment of sewage, and rigid inspection of rivers, difficulties sometimes arise as to the disposal of the effluent. Various chemical processes have been proposed to deal with this matter; but the scale of operations with which I have been concerned is not large enough to warrant their use, especially as the liquid must eventually be disposed of in any case. I have found that it is quite possible to make an effluent sufficiently pure, with the help of soda, to be used for the supply of the retort-house generator furnaces without annoyance to the furnacemen, and for various other purposes on the works, and that not a gallon of it need pass off the premises.

A simple test of the effluent by simple neutralization with acid is not of itself satisfactory, because it does not indicate whether the alkali consists of ammonia or of excess of fixed alkali. But it is useful in order to compare the total alkalinity with that of the ammonia obtained by the usual process of distillation. This process may have the effect of completing the work of displacement, if on account of irregular supply or insufficient mixing it has not been completed in the proper place. The liquid may contain an appreciable proportion of ammonia, and at the same time an excess of fixed alkali; and therefore it must not be concluded that ammonia in the effluent necessarily indicates the need for more fixed alkali. Possibly more intimate mixing or brisker boiling is required. The total alkalinity, less that found to be due to ammonia, indicates the excess of fixed alkali; and, as already remarked, a small excess is necessary if the ammonia is to be displaced completely.

Another objection to the use of lime is that, as it is only soluble in water to the extent of a few grains per pint of liquid, it must be used in suspension or as milk of lime; and it is more difficult to secure complete admixture than with a clear fluid such as the solution of soda. Soda ash or ordinary washing soda is the cheapest form of that substance that I am aware of; and it requires somewhat longer contact with the liquid than the pure or caustic soda.

All who are in the habit of working up the liquor at somewhat long intervals, such as twice a year, will do well to appreciate the fact that ammoniacal liquor does not, like port wine, improve with keeping. Apart from the risk of loss due to leakage in the storage receptacle, or by evaporation, there is a tendency for some of the volatile compounds to oxidize and pass into the fixed form. The effect of storing a liquor in bulk for six months will be an increase in the proportion of ammonia that cannot be displaced by boiling; and apart from this a stale liquor appears more unwilling to yield its ammonia than does a fresh one. Any sulphate maker experienced in this method will say that he is accustomed to get better results with the comparatively fresh liquor at the start than when he has come down to the stalest. Stale liquor means a more liberal supply of fixed alkali, or some loss of ammonia, and sometimes both.

It is not sufficient to take one set of tests and accept the results as an average for the year, because conditions of temperature and make of gas per hour are continually varying. A set of tests at the time of minimum make, and another at the maximum, will give the two extremes, and a larger number (say four) arranged to cover as nearly as possible the variations experienced throughout the year will be more satisfactory still. This also applies to the working of the sulphate plant, if there are any variations in the strength or quantity of liquor worked.

DOCTORS AND ELECTRIC LIGHTING.

Some remarks made at the recent International Congress of Medicine on the subject of the effect of electric light on the eyesight were dealt with in an editorial in the "JOURNAL" for the 19th ult. (p. 483). The fuller reports which have since appeared in the "British Medical Journal" make it possible to quote some further views advanced by the different speakers.

In the course of a discussion on "Affections of the Eye Produced by Undue Exposure to Light," Professor Carl von Hess expressed the opinion that the fear that injury to the eyes was caused by modern sources of illumination was to a large extent groundless; and discomfort could always be prevented by suitable shading of the lamps. After dealing with various conditions of the eye ascribed to too much or too little light, Mr. J. H. Parsons remarked that photophthalmia was due to undue exposure to sunlight, and one form was called snow-blindness. But it could also be produced by electric arc-lamps, and, in fact, any light rich in ultra-violet rays. Mr. Bishop Harman, in calling attention to the great change which had taken place in recent years in the general science of illumination, said that unprotected arc lamps, metal filament lamps, and high-pressure gas caused great retinal and cerebral fatigue. New lights of great intensity were put into old fittings, and shades were used in 100-candle power lights which were designed for those of 8-candle power. It mattered little how intensely an object which was being examined was illuminated; but it was most detrimental for the intense glare from a highly luminous point to strike the eye in an unprotected manner. He thought it should be an offence to display in a public place a naked lamp above 20-candle power, or any arc or equivalent lamp nearer than 30 feet above the footpath.

Another discussion was on "Visual Defects in School Children," which was opened by Dr. James Kerr (Principal School Medical Officer of the London County Council), who said that illumination by daylight should be efficient, and arranged to come from the left side. For artificial illumination, no school desk should have less than 2·5 foot-candles. It was also of considerable importance to protect the eyes from glare and shine. These were the chief points emphasized with regard to the school prophylaxis of low-grade myopia. Dr. L. A. Parry thought it was essential that school medical officers should have a training in diseases of the eye. He did not think that Dr. Kerr laid sufficient stress on the importance of arranging that school desks should be lighted from the left side. In his opinion, this was most urgent. Dr. Brindley James (who, in a report from another source, stated that since electricity has been substituted for gas, the eyesight of the students has been very much affected) stated that he objected to electric light on the ground that it gave a feebler illumination than gas; and Dr. Leslie Mackenzie objected to it on the opposite grounds—namely, that the light was too powerful and over-stimulated the retina. In his opinion, based on personal experience, and on the views of an eminent expert, the best light for reading at night was a paraffin candle. In replying, Dr. Kerr said that he agreed that electric light contained rays which were peculiarly irritating to the retina, but thought that the question was one of physiological adaptation of the eye.

The Yorkshire Junior Gas Association are next Saturday week to inspect the works of the Richmond Gas Stove and Meter Company, Limited, at Warrington. There are two works to be visited; and the Company are making provision for them to be running at the time of the inspection. After the visit, the members will be entertained at tea at Warrington.

Benzol Recovery on Gas-Works.—It is announced that the Königsberg Corporation are erecting at their gas-works a new installation of large carbonizing chambers or ovens, which will be worked at uniform load throughout the summer and winter. In winter, the settings will be heated from central gas producers; but in summer all the surplus gas produced will be dealt with in bye-product recovery plant, and after treatment will be used for heating the settings. The recovery plant will comprise washers, stills, &c., for the production of either 90 per cent. benzol or pure benzene; and it will be capable of treating 4¼ million cubic feet of gas per 24 hours.

TRADE UNIONS AND CO-PARTNERSHIP.

Discussion at the British Association Meeting.

THE Economic Science and Statistics Section of the British Association on Thursday last, discussed the above question in connection with a paper by Mr. CHARLES CARPENTER, D.Sc., and another communication by Mr. J. B. C. KERSHAW.

ARE TRADES UNIONISM AND CO-PARTNERSHIP INCOMPATIBLE?

By CHARLES CARPENTER, D.Sc.

It will probably conduce to a clearer understanding of the problem to be discussed if some consideration is given by way of preface, not so much as to what we mean when we speak either of "Trades Unionism" or of "Co-Partnership," but rather to definition of the aims of both, and we then endeavour to discover whether, either in the goal to be reached or in the paths thereto to be traversed, incompatibility exists.

TWO TYPES OF TRADES UNION.

Broadly speaking, the trades unions may be grouped under two heads—viz., those of skilled and unskilled workers, of the artizan and the labourer. There is, of course, no hard-and-fast line of demarcation between the two, as a greater or less degree of skill is necessary in following all industrial callings. As examples, may be mentioned occupations involving the handling of a shovel or the swinging of a hammer, though these operations would, however, require on the part of the workman dexterity rather than such craft as would be exercised in, let us say, constructing the panels of a door truly and rectangularly, or in preparing the supports or bearings for a crank-shaft so that it may easily revolve in them.

It would occupy too long to discuss in detail the particular aims of the many unions registered in Great Britain; and it must suffice to use certain examples as illustrations. For this purpose, we may take the Amalgamated Society of Engineers as a type of one of the older unions of skilled tradesmen, and the National Union of Gas-Workers and General Labourers as an example of the newer combinations of unskilled workers. The former was founded more than 60 years ago; it has a membership of upwards of 120,000; and its objects are set out in its rules as follows:—

(*a*) To protect and regulate the conditions of labour in, and the relation of its members with, the engineering trades.
(*b*) To assist its members when out of work or in distressed circumstances; to support them in case of sickness, accident, or by superannuation; to supply them with legal assistance in obtaining redress for accidents; and to provide for their burial and that of their wives.
(*c*) To assist such of them as desire to acquire possession of their dwellings.
(*d*) To aid by federation other societies having similar objects.
(*e*) By extending its system of investments for co-operative productive purposes to assist in altering the competitive system of industry for a co-operative system so as to secure for the worker a full share of the fruits of his labour.

The National Union of Gas-Workers and General Labourers was founded more recently (hardly 25 years since); and its rules state the following to be its objects:—

(*a*) To shorten the hours of labour, and obtain a legal eight hours working day; to abolish, wherever possible, overtime and Sunday labour, or, where not possible, to obtain payment at a higher rate; to abolish piecework; to raise wages; and where women do the same work as men to obtain for them the same rates of pay.
(*b*) To abolish the present system of contracts and agreements between employer and employed, and to enforce the provisions of the Truck Act.
(*c*) To settle labour disputes by amicable agreement wherever possible, and to obtain equality of employer and employed before the law.
(*d*) To provide relief for the disablement of its members.
(*e*) To obtain legislation for bettering the lives of the working class.
(*f*) To secure the election to Parliament and municipal bodies of members of the union pledged to the collective ownership of the means of production, distribution, and exchange, and to assist similar organizations having similar objects.

It will be obvious from this comparison of the aims of the two societies taken as examples, that trades unionism does not always mean quite the same thing; and this view will be emphasized by reference to the foreword with which each set of rules is introduced to the members of the respective organizations.

The engineers' union assumes that every artisan following a given occupation has an interest in forming rules by which that particular trade shall be regulated, and by concentration of means to enable himself to make his power felt, and obtain security against the risks to which he would otherwise be exposed. It points out that, although during employment its members may obtain the necessaries of life, yet the fear of loss of work is not absent, and its happening brings with it the shattering of the workers' hopes of improving by frugality his social condition. Finally, it expresses the belief that if its members do their duty, not only may a craft or trade be handed on to a future generation, but also the means of maintaining its best interests until some more general principle of co-operation shall come into being, whereby every man has the full enjoyment of the product of his labour.

The gas-workers' organization strikes another and a different note. It affirms that in trades unionism lies the hope of the workers for the future. But the unionism must be one which, definitely assumes that to-day there are only two classes—the producing working class and the possessing master class; and that the interests of each class are opposed to those of the other. No help, it is stated, can be expected from the masters as a class; the workers' only hope being in themselves—an army of labour which, by its organization and union, is marching steadily forward to its goal, the emancipation of the working classes.

Here, then, we have two trades union pictures, painted, not by the author, but by the organizations themselves; and the finishing touches in both instances are as recent of application as a year ago, within which time their rules have been in both instances brought up to date.

THE OBJECT SOUGHT BY CO-PARTNERSHIP.

Let us now turn our thoughts to the object sought by co-partnership. Whatever the particular industrial organization may be, labour (skilled and unskilled) is essential to it in greater or less degree; and the employer goes into the market with the primary idea of obtaining his requirements as cheaply as possible. In many cases, the trades union has been there before him, and settled the hours to be worked and the rates to be paid to the workers, and the employer has to make the best of the human material thus provided—the tenure of its employment being not infrequently terminable by one hour's notice (rarely more than a week's) on either side. The co-partnership employer, however, goes much further. In effect, he says to the labourer, "I want something more than a hireling. I am willing to take you into my business as a partner. I will pay you the rates of wages and you shall work the hours which are customary in the trade. If you sign an agreement of service with me, in return I will undertake by it to share with you the profits we make together—I largely by brains, you largely by labour—after (say) 4 or 5 per cent. has been paid as interest on the capital I have laid out." One other factor has to be brought into the partnership—namely, its duration. In the case of carrying out specific works, such as the construction of a harbour or the building of a ship, the time-limit of the partnership may be the completion of the respective tasks; in the case of continuing businesses, such as the working of a railway or the manufacture of chemicals, the agreements may be for yearly or quarterly periods, renewable from time to time.

CO-PARTNERSHIP IN GAS SUPPLY UNDERTAKINGS.

Having thus stated definitions, we can now proceed to consider relations. I will begin by referring to a historic one—that between the South Metropolitan Gas Company and the Gas-Workers' Union. Gas manufacture is a continuous process; that is to say, it has to be carried on day and night. Prior to 1889, the labour in London, though not in some other parts of the country, was provided by a day-shift and a night-shift of men—thus dividing the twenty-four hours into two parts. In the spring of that year, the Union put forward a demand for the day to be divided into three eight-hour shifts, instead of two twelve-hour shifts, without reduction in pay. This was granted. But, instead of being content with so great and bloodless a victory, the leaders organized a sort of guerilla warfare. Scarcely a week passed but some concession would be demanded—often too unreasonable to be given willingly, but generally too small to risk a quarrel over, until at last it was openly spoken, "You have only to ask for gold watches and you'll get them." Such was the temper of the retort-house men in the autumn of 1889, when it became apparent that the seeds of their discontent were beginning to spring up among the artizans, mechanics, and labourers who formed an equally large and important part of the staff, and who said in effect, "It is time *we* asked for something." Mr. George Livesey (as he then was) felt the moment was ripe to act, and offered his profit-sharing or co-partnership scheme to all of his employees who chose to accept it.

I must pause here for a moment to give a word of credit to the man who first publicly proposed the sharing of gas-works' profits with employees. The sliding-scales under which the London gas undertakings carry on their work originated with Mr. Livesey; and by them, as is well known, only a fraction of any profit made above 4 or 5 per cent., as the case may be, goes to the shareholders—the major part passing automatically to the consumers by way of reduction in the price they are charged for gas. In 1882, Mr. Thomas Travers, the Manager of the Cork Gas-Works, in a paper upon "Industrial Co-Partnership," expressed the opinion that Mr. Livesey "only performed half the work when he settled the sliding-scale for the benefit of the consumers and the proprietors, and omitted the workers, on whom the labour devolved of making it a success. He had no doubt that co-partnership

would be the system of labour in the future." Mr. Livesey's remarks upon the occasion are very interesting. He is reported to have said that "he always felt the work would not be complete if it stopped at the shareholders. After the sliding-scale principle was adopted, he brought the matter before the Directors of his Company, but they would not hear of it."

In 1889, wiser counsels prevailed; and the Board listened sympathetically to his voice. The profit-sharing scheme was thus started, and agreements of co-partnership were voluntarily entered into by all the Company's repairing staff. But the stokers would have none of them. Three stokers, however, signed-on; and when the Union heard of this, it demanded their removal from the works, and that of all other men who had entered into agreements, as well as the abolition of the profit-sharing scheme. The demand was not complied with; and, after a week's notice, in the middle of December the whole of the retort-house men went out on strike. The strike failed; and soon afterwards the Secretary of the Union made a public speech, in which he warned the people of London that a week's notice would not be given of the next one. As a result of this, a declaration was incorporated in the agreements of employment that the workman signing was not a member of the Gas-Workers' Union. This stipulation has, however, long since been omitted; for the fear of strikes has lost its terrors under co-partnership; and unionists are as eager as non-unionists to sign for assured service,

One other fact deserves to be recorded. It is that since 1889 the wages of gas stokers in London have been twice substantially increased on the initiative of the Companies, and without the intervention of the Union.

So much for the attitude of one trades union to co-partnership. On the other hand, the same Company employs a large number of other workers than the retort-house men—for instance, artizans of all kinds, bricklayers, carpenters, plasterers, plumbers, machinists, fitters, &c.; and no antagonism has ever been shown to the Company's co-partnership by their respective unions. The right of combination among workers is admitted without question by the advocates of co-partnership. The payment of trades union wages rates is equally accepted as a principle by them; and the question of hours is nowadays not likely to give rise to difficulty.

Agreements for Service.

Let us now discuss the matter of the agreements specifying definite periods of service, which are held up as a bogey by some opponents of co-partnership. One would almost think that signing a co-partnership agreement was equivalent to taking the King's shilling. As a matter of fact, there is no such analogy. Taking the agreement of the Company referred to as a type, it is a mutual bargain on the following basis:

The Company contracts to employ the man for a fixed period if he remains sober, honest, and industrious, and able to perform his work. The man agrees to work in the capacity in which he is employed at the current rate of wages (which it is stipulated shall not be reduced during the running of an agreement) and, further, to obey the orders of the foreman in charge. In return, he gets a share in the profits, amounting at the present time to 8¼ per cent. on his wages. The contract can be cancelled by mutual consent before its expiration, if it is found that the man's services can be dispensed with without detriment to the Company. The agreements do not terminate all together on one particular date. If the signing-on were for a particular job, this would be possible; and the method is indeed adopted by the Company in filling its seasonal as distinct from its regular requirements of labour. The great bulk of its employment is, however, continuous year in and year out; and in such cases they terminate in about equal quantities every month.

Oh! it is said, but this prevents men striking simultaneously or putting forward organized demands for shorter hours, better wages, or improved working rules, and all chance of going out on a sympathetic strike is averted. Nothing of the sort! No agreement of service would keep an organized body of men from striking if they were earnestly of opinion that their conditions of employment were unfair or unjust. They would strike despite any agreement they had entered into. If an association of, or individual, workers adopted such a course they would certainly run the risk of consequent punishment by fine or imprisonment. The workers, in whatever industry was concerned, would first have to make up their minds that the game was really worth the candle. They are perfectly well able to weigh the *pros* and *cons*, and to arrive at a conclusion concordant with their interests.

It is conceivable that, having been once bitten, they or their organization might say: "We will adopt as a principle no more agreement signing in future." But nearly 25 years' experience proves that without exception unionists and non-unionists alike are willing (nay eager) to sign agreements assuring them of employment, whether such unionists are engineers or gas stokers. Moreover, while workers are under agreements there is nothing whatever to prevent their bargaining, either by themselves or through their organization, in respect of hours, or wages, or conditions. If strikes are to take place, it would be better for them to be the result of deliberate judgment than hasty and ill-considered actions. Agreements will in all cases afford time for reflection, and give opportunity for some other and less primitive course to be adopted than "downing tools."

Advantages Gained by Co-Partnership.

This advantage is not the employer's only gain by co-partnership. More profit accrues by reason of the extra zeal and care exercised by his workpeople. His men are loyal, diligent, and trustworthy. Supervision is lightened, waste of time and material is lessened, and greater pains are taken to satisfy the requirements of the firm's customers. Above all, a spirit of contentment has arisen, not by any means from sacrifice of hope in the future, but, for the first time in most cases, by reason of an understanding of the principles upon which the industrial constitution is founded, and the knowledge that the opportunity to share in the wealth it produces has been accorded.

What are the alternative and usual terms of employment? An hour's notice in many cases, a week's in most others. At the expiration of the notice, the father of a family is no longer a wage earner; income from his toil ceases. Is there any wonder that the labourer should give in return for his hire no more than he is compelled? The South Metropolitan Gas Company has had immunity from strikes or the fear of strikes for nearly 25 years; and during all this period its employees have been enjoying the benefit of assured service for, in the majority of cases yearly terms, in the minority quarterly. Cannot a picture be formed of what this must mean? And is it not infinitely better than providing for the contingency of striking which may never happen?

Allocation of Profits under Co-Partnership.

It may be convenient to state here that, when the allocation of profits under co-partnership is spoken of by its advocates, they refer to those which arise after all requirements of the business, either necessary or voluntary, have been met. For instance, the provision of workmen's dwellings, institutes, holidays, pensions, &c., are considered purely as charges on the business, and not as being in any sense of the word a distribution of a share of profits arising out of the co-partnership.

Advantages of the System.

Just as the peer and the peasant have an equal right to the protection of the State, though their stake in it may greatly differ, so I hold that the worker should have accorded to him the right to share in the profits of the business with which he associates himself. I do not say an unrestricted right. Obligations must be mutual. But Parliament should recognize the principle that, capital and labour being essential to each other, their partnership should be the basis of all hiring or service agreements.

It has been sometimes urged that labour becomes less mobile under co-partnership. Less mobile by reason of holding some stock or shares in an industrial organization? Where does the immobility arise? Does not the possession of wealth make us more mobile rather than less, seeing that we have thereby the means necessary to enable us to avail ourselves of opportunities for locomotion?

Fortunately there is an exact reply to such a criticism by reason of the fact that some statistics are available as to what actually happens in the case of the co-partnership undertaking to which reference has been made. They do not go back very far, as the information has only been tabulated during the last four or five years. These records show that since 1908 293 men have left the Company's services to proceed to the Colonies, selling stock to an aggregate value of £8585, an average of £29 6s. [See table.]

South Metropolitan Gas Company.

Men Selling Stock to Leave Company's Service (and England) to go Abroad.

Year.	Australia.		Canada.		New Zealand.		South Africa.		South America.		Total.		Average per Man.
	No. of Men.	Value of Stock Sold.	No. of Men.	Value of Stock Sold.	No. of Men.	Value of Stock Sold.	No. of Men.	Value of Stock Sold.	No. of Men.	Value of Stock Sold.	No. of Men.	Value of Stock Sold.	
		£		£		£		£		£		£	£ s.
1909	13	385	8	360	5	115	—	—	1	35	27	895	33 3
1910	29	1060	21	740	3	105	1	25	—	—	54	1930	35 15
1911	51	1490	19	430	5	160	1	45	1	35	77	2160	28 1
1912	65	1690	9	325	4	75	—	—	—	—	78	2090	26 16
1913 (half year)	13	355	42	1000	—	—	1	20	1	135	57	1510	26 10
Total .	171	4980	99	2855	17	455	3	90	3	205	293	8585	29 6

In certain cases, it is true, employees voluntarily make some sacrifice of their mobility in order to acquire the houses they wish to live in. In the same Company, 116 co-partners have bought their houses outright, at a cost of £29,839; while 272 are still buying, having already paid towards the purchase £41,512. The figures as to the workmen's holding are very interesting. On Dec. 31 last year, 5593 the co-partner employees held in their own name stock with a nominal value of £301,480, or an average of £54 per man. In addition to this, £8635 is held by trustees on behalf of 2931 employees. How much is possessed by those who have left or retired from the Company's service, or by the descendants of those who have died, is unknown.

Accident Allowances.

These are great results; but co-partnership as practised by the South Metropolitan Gas Company has achieved much more. For many years it has had a mutual fund for providing allowances in case of accident. In 1892, it inaugurated a system by which the co-operative principle was invoked to reduce the number of industrial accidents. Since then every accident to life or limb has been the subject of inquiry by juries of co-partners, who endeavour to trace causes and suggest remedies. The results attained have been remarkable, as the following table will show:—

Year.	Number of Men Employed.	Number of Accidents.	Percentage of Men Meeting with Accidents.
1898	3664	299	8·16
1899	3903	297	7·60
1900	4488	318	7·08
1901	4920	315	6·40
1902	5019	259	5·16
1903	5071	286	5·63
1904	5359	267	4·98
1905	5478	243	4·43
1906	5674	210	3·70
1907	5707	269	4·71
1908	5568	192	3·44
1909	5726	206	3 59
1910	5933	221	3·72
1911	6226	246	3·95
1912	6473	261	4·03

Moreover, a body, called the Co-Partnership Committee, consisting of 54 officials and workmen in equal numbers, has met regularly for the last 23 years to discuss all sorts of questions pertaining to the welfare of the Company and its employees. The men's representatives are elected by ballot of the co-partners; and one could not be present at a single meeting without being impressed by the advantages to be derived from educating employer and employed in the mutuality of their interests.

Employee-Directors.

It is not improbable that the successes attained by the Co-Partnership Committee and the Co-Partnership Juries were factors in determining Sir George Livesey to press for the inclusion of co-partnership on the Board of Management of the Company. In face of considerable opposition, the scheme was carried; and since 1898 employee-Directors have had seats on the Board and have taken their full share of its deliberations. The complete Board consists of ten members, three of whom are elected by the co-partnership employees. The aggregate holding of employee shareholders empowering the election of employee-Directors is required to be not less than £200,000 nominal stock The qualification of the employee-Director is two-fold—*i.e.*, fourteen years' continuous service, and the holding for not less than one year prior to election, and continuing to hold, not less than £120 of stock. Criticism has been levelled against the system—on the one hand because the representation is proportionately largely in excess of that accorded to the ordinary shareholders, and, on the other, that the number of employees is too few to influence the decisions arrived at. An experience of fifteen years has shown that such objections have no foundation in fact. The employees' representation to be effective must be tangible, and not a mere matter of form. Influence is a matter of personality rather than majority; and the various choices made, though differing in kind, have always been excellent.

Conclusions.

Let us now sum up and see how far it has been possible under a co-partnership to reach the goals sought by the two Unions taken as examples at the outset of this paper. We will begin with the engineers [see *ante*].

(*a*) No difficulty as regards conditions of labour or relationship with its members has arisen.

(*b*) The co-partnership bonus provides a nest-egg available for special cases, such as loss of employment or distressing happenings. Mutual funds to provide for sickness, accident, and burial have existed for 71 years, and for superannuation for 58 years, while for the past 21 years the circumstances of every accident have come before a jury of workers.

(*c*) The co-partnership has enabled many to purchase their houses.

(*d*) The example of this co-partnership has been followed in nearly every particular by many others.

(*e*) The value of the employees' holding in the Company for which they work is about £350,000.

Let us now deal similiarly with the gas-workers:

(*a*) The working day is one of eight hours throughout. Overtime and Sunday labour are obviated as much as possible; but, when unavoidable, are paid for at higher rates. Piecework is, however, mutually preferred whenever it is possible to arrange it.

(*b*) Agreement contracts are desired and voluntarily entered into by members of the Union in this as well as in other companies. Contributions to the various funds are only collected by the Company on the personal request of the employee.

(*c*) The Co-Partnership Committee provides machinery for this purpose with an equality of representation of workmen and officials.

(*d*) The disabled are not only provided for, but means are continuously sought to reduce their number.

(*e*) Co-partnership, and the provisions under it for workmen-directors, have been recognized by the Legislature.

(*f*) Co-partnership is put forward as being a solution of the labour problem in advance of that possible under what is called collective ownership—each industry having its own colonies of workers contentedly endeavouring to improve their lot in life as well as to increase production.

In the foregoing, I think I have proved that the goals of both co-partnership and trades unionism cannot be regarded as incompatible. In conclusion, let me briefly refer to the paths by which these goals are to be reached, for it is therein that the great difficulties have lain in the past and exist to-day.

The employer in most cases regards the union as an enemy—too often, it is to be feared, correctly. But the conditions of industry have not been in the past suitable to develop friendship between employer and employed; and the routes followed towards the progress it is in the interests of both to aim at, have been chosen in most cases for fighting lines rather than as roads for peaceful traverse.

Under co-partnership we have now incontestable proof that antipathy between master and man dies down, and mutual respect and friendship take its place. Trades unions will thus have no further need for their most cherished weapon, which they can afford to throw aside, and to journey side by side with the employers in a united pilgrimage towards the goal they will seek, as they must always seek, in common—the triumph of their industry.

DISCUSSION.

Mr. Kershaw, in the course of his remarks, discussed the statistics of the co-partnership movement in the light of the facts and figures given in the latest Government report on profit sharing and labour co-partnership in the United Kingdom, and then dealt with the causes of past failures, more especially with the objections of the trades unions and their leaders to all extensions of the movement beyond its present limited field of application. Mr. Carpenter had certainly shown the great success which had attended the South Metropolitan Gas Company's co-partnership scheme. But why had co-partnership not made still greater progress generally in this country? There were 33 schemes in the gas-making industry, affecting 28,000 employees, and 90 schemes in other industries, affecting 78,000 employees; and only this as the result of fifty years application of profit-sharing and co-partnership in this country. Evidently some influence was at work undermining confidence in the schemes; and this influence was, in his opinion, the hostility of trades union officials towards the movement. The argument had been put forward that co-partnership schemes tended to split up the workers into small parties, and militated against consolidation of the men. It had also been said by the men's leaders that the South Metropolitan Gas Company's scheme had been initiated to counteract the strength of the Gas Workers' Union. His proposals for overcoming trades union hostility were: (1) Perfect freedom for all workers to join their respective unions if so inclined; (2) recognition of trades union rates of pay as a basis of the co-partnership scheme; (3) election of selected leaders in each industry and each locality as directors of large firms or companies. This latter he advocated as being of great educational value, inasmuch as the men's leaders, while having a fixed income for the work which they would so do, would gain an insight into the difficulties of running large companies and industrial concerns on business lines. It would also enable the workers' grievances to gain a more direct hearing than was frequently the case to-day. He expressed the opinion that the wave of unrest which is still troubling the industrial world in all countries would only be calmed and give place to more harmonious co-operation between capital and labour when the manual workers were given a larger share of the profits of industry, and a greater stake than they now possessed in the welfare and prosperity of the country. Co-partnership, in his opinion, was the most simple and effective means for bringing about this change in the organization of our industries and at the same time preserving the efficiency of financial and technical control, without which no industry can succeed in modern days. Past failures in the attempts to run industries entirely by working men for the workers' own benefit had proved the need for closer co-operation between capital, brains, and labour. The three essentials for the

successful conduct of modern manufacturing industries were: (1) A plentiful and cheap supply of capital; (2) a plentiful and cheap supply of skilled and contented labour; (3) skilled technical and business management, which could take instant advantage of all opportunities offered for improving the manufacture and for extending the market for the finished goods. The co-partnership principle was the one which offered the best chance of attaining these three conditions of success; and if trades union hostility to the principle could be disarmed, the movement would extend with amazing rapidity.

Professor W. J. Ashley expressed the opinion that where trade unionism was strong, co-partnership was impossible and impracticable, and that not necessarily because of any moral defects on the part of trade unionists or their leaders. Some of the remarks made that morning as to trade union leaders were not only unfortunate, but inaccurate. This was not a question of personal defects on either side—it was a question of a deep-seated divergency of principle. The principle of co-partnership was the principle of the solidarity of the workmen of a particular concern and their employers. The principle of unionism was the principle of the solidarity of the workmen in the whole industry and in all concerns in that industry, and not necessarily against the employer, though it might be in face of him. Therefore any policy which sought to detach workmen of a particular concern from the common movement of the men of that industry must necessarily be opposed to the trade unionists. They had no alternative in the matter; and he agreed that it was not a very cheerful state of affairs. Collective bargaining with strikes and lock-outs to fall back upon was uot a very perfect way of adjusting difficulties; but it was the way along which we were moving, and he was convinced that, so far as the staple industries of the country were concerned, their hope was not in the direction of destroying trade unionism but in working with and through the unions. More satisfactory methods of collective bargaining were required, and general agreements could not be arrived at unless there were strong combinations on both sides—combinations of employers as well as combinations of men. The South Metropolitan Gas Company had enormous advantages in arriving at a co-partnership scheme, inasmuch as they had, in the first place, practically a monopoly, which gave an assured profit and a regular one. Thus the Gas Company were able to grant something to the men year in and year out. There was consequently the greatest possible incentive to economy on the part of the men; and as in the gas industry profits could only increase if the price fell, it was to the shareholders' interests to encourage economy in production among the men. Again, another advantage in favour of the gas and water industries was the system of criminal penalties attaching to breach of contract on the part of the employees, which he believed did not exist with regard to any other industry.

Mr. George Cadbury said he did not think it at all fair to use the gas industry as an argument to be applied to any of the staple industries of this country—[applause]—and he warned anybody not acquainted with the problem that the gas industry could not be taken as an analogy of what would occur in other industries. Mr. Kershaw, he was afraid, was not at all in touch with trade unionism in this country, and he had given quite a distorted view of the aims and wishes of the working men. He felt it his duty to raise this protest as an employer who had had to bargain a good deal with men from time to time. From the employers' point of view, there was a great deal to be said for co-partnership; while, looking at it from the workman's point of view, it was clear that he was thinking more and more for himself. Twenty years had made a vast difference in the working man; and he doubted whether what happened in 1889 with the South Metropolitan scheme would happen again now if the same circumstances were in operation. The workman would now think twice before in any way, as he felt, limiting his freedom in the first place, and, secondly, driving a wedge between himself and his fellows. He would look at the reward very carefully before he even thought of doing any such thing. The great point nowadays was class solidarity. Even supposing the whole of one trade was in co-partnership, that would not remove the objection which the workmen would have, and they would say that, for an increase of 5 per cent. in wages—he believed that this was what was usually promised—it was not worth while breaking the class solidarity and driving in a wedge between one set of workmen and another. Such a comparatively small increase of wages they did not think worth much, because they felt they had other means of securing such an increase which would leave them more freedom. Rightly or wrongly, he believed this was their view.

Mr. C. R. Fay (Secretary of the Economic Science Section) said he agreed with co-partnership as developed by Mr. Carpenter, but could not agree with the principles propounded by Mr. Kershaw. The success of co-partnership depended upon the generosity with which the opponents' point of view was taken; and the whole policy of the South Metropolitan Gas Company under the guidance of Mr. Carpenter and his great predecessor had been to take a large and generous view of those who did not agree with them. There were, of course, favourable circumstances, as had been pointed out, and full use had been made of them. The same was the case, perhaps, in the soap industry, where Sir William Lever had inaugurated a similar scheme. It was not, of course, suggested by such employers that co-partnership was a panacea for universal application; and he did not think the South Metropolitan Gas Company were suggesting this. It could only be applied in industries having similar conditions.

Mr. Charles Wickstead (Manchester) said the present industrial upheaval could not be wondered at, when it was a fact that in Manchester in many leading firms there were workers only receiving 18s. per week, in face of the enormously increasing wealth of the community which was going on day by day. He was, nevertheless, astonished to find so many intelligent working men looking towards trade unionism, especially in its present state of development. Unionists used to attack employers; now they attacked society. Everybody, however, should work for a fair economic basis for the country. One of the greatest necessities was goodwill between employers and employees; and, as an employer of labour, he had no hesitation in saying that, if the men would only advance in this way, they would get all they could reasonably desire. Strikes were the cause of enormous loss, and especially to the men. A man should try to get what he wanted with the least possible loss to himself; but the very reverse was the policy of the trade unions. They seemed to try to get what they wanted, with the greatest possible loss. There was a distinct want of consideration, and this was why all the conflict went on. With regard to the increasing wealth, which was seen in almost all our large shops in the continued introduction of labour-saving machinery, he would have a Government pronouncement showing statistically the increased wealth-producing power of the country; and wages should be increased, not decreased, on the basis of the value of the increased production of the nation. By maintaining goodwill between employers and men, an increase in production could be brought about which, under this system, would mean an increase of 25 to 50 per cent. in wages.

Mr. Arnold Lupton did not think we should ever prevent strikes; and, after all, he did not think this a very bad thing. In a particular industry, big strikes only took place once in 20 or 30 years, and they did good, if only in teaching the general public to rely upon itself more, and do without some of the luxuries which were now so common to everyday life.

Mr. Carpenter, in reply, reminded the meeting that his paper was on the compatability of co-partnership with trade unionism. He was not acting as a general advocate of co-partnership, because this would require separate and particular treatment. But he was endeavouring to prove that co-partnership was not incompatible with trade unionism and that the aims of both were practically common ones. Whether the conditions under which a gas company carried on its business were the same as those under which an ordinary manufacturer carried on his business, he did not think entered very largely into the question. The gas company had to employ labour of all descriptions and pay the trade union rate for it. There was nothing in co-partnership to prevent collective bargaining or the putting forward of the views of the respective organizations by the persons appointed for this purpose. Mr. Wickstead had referred to the possible results for goodwill between the men and the employers. If such a result could be achieved, it would do more than anything else to prove the advantages that could be obtained by the employers and men working in the same direction. Twenty-three or twenty-four years ago, the South Metropolitan Gas Company would have said they were model employers, but had learned they were nothing of the sort. To-day, however, the Company did feel they were doing something in the direction of solving a problem which had become a very different one from what it was 25 years ago. Then the great bulk of the men were ignorant; but, as Mr. Cadbury had pointed out, now they thought for themselves, and realized they should have more of the wealth which the country produced. It was admitting these facts which would enable people to deal with the question in the way that had been indicated.

A hearty vote of thanks was accorded to the author of the paper at the conclusion of the discussion.

New Budapest Gas-Works.

The following particulars were given on Wednesday last in the Engineering Supplement of "The Times" with reference to the recently completed first section of the new central gas-works for the city of Budapest. The capacity of this section is 9½ million cubic feet of gas per 24 hours; but when fully completed the works will be equal to an output of 30 million feet a day. Coal can be brought either by rail or by water (the River Danube forming one boundary of the coal-store); and the machinery used for handling the coal and transporting it as required is of the most modern type. The carbonizing portion of the works consists of 78 Koppers horizontal chamber ovens, arranged in two batteries each of 19 ovens and two of 20 ovens. The ovens will carbonize approximately 800 tons of coal a day. The charge for each oven is about 10½ tons; and it is carbonized for a period of 24 hours. The ovens are of the regenerative type, and are heated by means of producer gas made in a central plant situated a short distance away. This plant consists of 12 Kerpeley rotating grate producers, ten being of the ordinary type for gasifying Hungarian brown coal, while two are high-pressure producers to gasify fine coke. Before being used for heating the ovens, the producer gas is cooled and thoroughly cleaned. It has a calorific value of about 140 B.Th.U. per cubic foot; and before being burnt in the heating flues of the ovens, it is preheated, together with the air necessary for its combustion, in regenerators, to a temperature of about 1000°. The direct process is adopted for securing the recovery of the whole of the ammonia from the gas.

VICTORIAN GAS MANAGERS' ASSOCIATION.

Questions Discussed at the Seventh Annual Meeting.

In the last number of the "JOURNAL," we gave a report of the general business at the seventh annual meeting of the Victorian Gas Managers' Association, held in Melbourne last November, with the address of the President—Mr. J. W. Thompson, Chief Superintendent of the Metropolitan Gas Company of Melbourne—some remarks by the Hon. George Swinburne on his visit to Europe, and other matters. On a subsequent page, one of the two papers read at the meeting (together with an abstract of the remarks to which it gave rise) is given—prefaced, below, with notes of the discussion on the subjects in the "Question-Box."

I.

"What is the best method of treating foul oxide for revivification, and is it necessary to have a roof over the revivification floor? What kind of floor is the most suitable?"

Mr. T. LORD (Geelong) said that, so far as his experience went, when the purifiers ceased to take up the impurities from the gas he had them emptied, and the oxide spread on the revivifying floor. A good deal depended upon the room a gas manager had upon which to spread it. Speaking from memory, he had something more than 3000 square feet. He always spread the oxide from 4 to 6 inches deep for revivification, because the shallower it was spread the more quickly it would revivify. Every revivifying floor should have a roof over it, to keep out the rain. He had one over over his shed which would cover a floor of more than 4000 square feet. His floor was asphalted, and he did not think a better one could be obtained for the purpose. A more substantial floor could be made of brick; but he did not think this was necessary. He had had an asphalted floor in use for twenty years, and in that time only two places had required repairing, and they were not very bad. He emptied an average number of four to five boxes a year. He was a believer in mixing breeze with his oxide. He put on his bottom grids a layer of breeze—anything from 4 to 6 inches deep—and his oxide went on top of it. He also mixed a proportion of breeze with the oxide; and it was very beneficial indeed. He seldom found that the oxide went very hard. On the whole, he believed in having a roof over the revivifying floor. By all means let the sides be open, so that the oxide could get the full benefit of the atmosphere. This was the main thing in revivifying. At Geelong, they turned the oxide once a day during the first week it was on the floor.

Mr. E. TIPPER (Box Hill) said he certainly thought it was an advantage to have a good hard floor, because this prevented waste of material. A roof was perhaps advantageous in a rainy period, because if there were no roof the oxide had to be heaped up when it rained. In his opinion, everything depended upon the area at one's disposal, and the particular style of purifying-house. One might have a revivifying floor above or below. He remembered seeing one which struck him as particularly modern, where the floor was above; and he saw a box, 50 ft. by 30 ft. by 6 ft., recharged in six hours. But there was another thing—revivification *in situ*. He had not tried it in Australia, but he had seen it tried in the Old Country. The point was not to renew the purifiers until they got the maximum of impurity in them. Alternately, they should blow through steam until all the impurity it was possible to remove was taken out; and a great thing to remember was to knock it about as much as possible. Whenever one had a bit of spare labour, he should let a man be turned on to this work. But, like other things, revivification would end in being done mechanically. There would be a tower with an elevator that would raise the oxide to the top, and a blast of cold air would be used.

Mr. H. V. MITCHELL (Brighton) said, so far as revivification *in situ* went, he had had some experience of this in the Old Country. He used to admit from 2½ to 3 per cent. of air into his purifiers; and he found that his oxygen on the outlet went down to 0·5 per cent. He did more good by joining to this method a different order of rotation of the boxes. Providing his material was fairly active, when he had cleaned No. 1 box in a series of four, by putting his clean oxide through, he at once made it his dirty box. He found that his foul gases went into the clean box, leaving the air to go into the next box ready to do its revivification. In the summer time, he found that revivification was much more active than in the winter. On one occasion, however, his second box in the series was very foul. The first box, of course, was black, the third was showing a stain, and the fourth was clean. He emptied No. 1 and put in clean oxide with 25 per cent. of sulphur, fairly active, and passed 3 per cent. of air. This box, through the day, became very active, and took out all the apparent sulphur; and he found during the next two days that No. 2 box had cleaned itself. If he used his purifiers in rotation according to the ordinary rule—viz., making his recently filled box the last—he did not get revivification carried out so completely as he did by making his recently filled box the dirty one. The boxes that he had were 25 feet by 30 feet square, and there were between 60 and 70 tons of oxide in them. They were passing regularly 55 millions through each box before they were foul; but after adopting the method he had described, he passed upwards of 120 million cubic feet through each box.

Mr. SIMCOE (Ararat) said he had had experience with purifier boxes in the open. He attached a 7-inch fume pipe to one box, and took a plug out of the crown of the cover and let the air pass through while the oxide was in position. When the other boxes fouled, he simply connected-up again. In this way, he cleaned the oxide. He had not emptied a box for more than two months, though they fouled every five or seven days.

Mr. S. E. FIGGIS remarked that if revivification could be done *in situ*, so much the better; but in the Maitland coals the percentage of sulphur was so much greater than in the Newcastle coals that it made the question of revivification a very difficult one indeed. In Ballarat, where revivification *in situ* had been carried on from year's end to year's end, he might mention, as showing the difference between the two coals, that, whereas with Newcastle coals they often ran for six months without changing boxes, they now thought they did very well if they ran for five or six weeks without lifting the lids, turning the material up, and giving it air. This was since they had been using Maitland coal. Of course, a chemical change took place in revivification. The nearer one got the oxide to dryness without actual ignition, the quicker it would revivify. This was one reason why he would certainly have a roof over the oxide, because if it got wet, there could be no ignition at all. As regarded the floor, as Mr. Lord had told them, asphalt was as good as anything. A point on which he had had practical experience was that if, when the oxide was very much spent and past use, it was taken out of the purifier and stored in some corner of the yard, in hot weather it would fire, and when it had done firing it became fresh oxide as good as new, and could be used in the purifiers again. He had seen 20 tons of oxide treated in this way; but someone was nearly put in gaol for it, as it fumigated the whole town. Men had to be sent down to put out the fire; but it made excellent oxide.

II.

"What is the best form of exhauster for gas-works—the steam-jet or the rotary?"

Mr. BOWMAN said it had struck him that the steam-jet exhauster was not exactly put out of court yet. He found it a very useful machine. There were no working parts to get out of order, and it was very easily run, and was not costly. All one need have was a boiler and a governor, and there was no wear and tear except on the boiler. The exhauster had been blamed for the formation of naphthalene; but it was a very open question as to whether it was not better to have the naphthalene formed in the works than to let it go forward into the mains. He had found that it got into the condenser; but it could be blown out in a few minutes by turning on the steam-jet.

The Hon. GEORGE SWINBURNE said he should like to know what Mr. Bowman's temperature was before his exhauster and after it. With regard to the steam-jet exhauster, one must have with it a little boiler, which was always a useful thing in gas-works. In many gas-works, one could use a gas-engine and a rotary exhauster. It was a question of condensing and temperature. If Mr. Bowman had a steam-jet exhauster, he might give the members information as to whether it was necessary to put in a condenser before as well as after, in a hot climate like theirs.

Mr. BOWMAN said he had a set of condensers which to some extent eliminated a lot of the heavy draught. One set was before and two were after the exhauster. The condensers before the exhauster were water-jacketed. He had lost two thermometers, and had not had an opportunity of testing. The gas heated the water in the first condensers up to 105° Fahr. But the trouble commenced when one began to cool the gas. As soon as it reached normal temperature, the naphthalene was formed out of it.

Mr. F. TIPPER (Melbourne) said one thing had occurred to him in favour of the rotary exhauster. With a steam-boiler one would need to have a boiler attendant, and would then come under the Factories Act; but with a rotary exhauster this could be avoided. The matter was also largely one of capacity. The steam-jet exhauster had its limits. For small works it might be very good; but he would even then question its advantages over the rotary exhauster driven by a gas-engine.

Mr. J. LORD (Williamstown) said he had had nearly 22 years' experience with a steam-jet exhauster, and had given a pretty good account of it at a former meeting. He got along very well with it. In previous years he used to have a great deal of trouble with naphthalene. He shifted the steam-jet exhauster from place to place until he got it fixed behind everything; and since then he had had no trouble, nor had he seen a sign of naphthalene. He did not think there would be trouble with the steam-jet exhauster anywhere if people took care to get all the tar out first.

III.

"Would it be advantageous to form a Gas Publicity Committee?"

Mr. MITCHELL, in venturing to introduce the suggestion for the formation of a Gas Publicity Committee, said he was perfectly aware that he was not breaking new ground. Such a Committee

had already been formed in the Old Country, and though it had been working only a few months, he ventured to say it had already amply justified its existence. It had, he was glad to say, received financial assistance from their side. In Germany also a similar Committee was doing great work. It seemed to him that it was high time they had in Australia a central bureau for the purpose of carrying on a healthy and vigorous gas propaganda—for a stirring, militant campaign in favour of gas, not merely for cooking and heating, but for lighting. The campaign need not necessarily be directed against electricity (there was room for both), but to insist upon the advantage of gas in its many forms of application; to educate the public, by means of posters, advertisements, and articles in the magazines, so that they might appreciate more fully the undoubted benefits derived from the use of gas, and to bring before their notice persistently the fact (notwithstanding what the general and electrical press might say) that gas was not a dying industry, but one that was strong and vigorous and increasing daily in scope and usefulness to mankind. He submitted that the time had come when it was necessary to reply to the misleading statements and misrepresentations appearing from time to time in the Press. He need not labour the point that their electrical friends were leaving no stone unturned to oust gas from its position as the finest lighting and heating medium of all time. What he wanted to emphasize was the fact that it behoved gas people to bestir themselves and act in concert in this matter It was pathetic to think of the small gas manager, who so largely predominated in the Association, and was often in an isolated position, having to be content with what the electricians reluctantly left him in the shape of cooking and heating, and this almost entirely due to the fact that popular prejudice, influenced by the Press, ran in favour of electric lighting; because, in the words of the paragraph writer, it was "more up-to-date" and was "the new light," &c. His idea was not so much to read a paper as to open a discussion on what one must admit was a vital question. It was admittedly a great thing to make and supply cheap gas; it was often a more difficult thing to sell it. There were many householders who were so easily swayed by newspaper opinions and advertisements. Not only did they require to publish broadcast the advantages of gas, but they wanted to educate the public to appreciate the most economical methods of using it; for they had, even among supposed friends, persons who every day (perhaps unintentionally) were doing the gas industry more harm than good. He referred to the vendor of cheap gas-burners, mantles, &c. Further, the plumbers, or a large number of them, were woefully ignorant of the correct method of piping houses; and he thought it was indeed high time that plumbers carrying out gas-fitting work should be compelled to pass an examination, or that the work should be passed by the local gas company, for he had found—and he had no doubt he was not alone in the matter—that a great many of the complaints received were due to faulty work in piping houses.

The Hon. GEORGE SWINBURNE said when he was at Cambridge, on the occasion of the meeting of the English Gas Institution, in 1912, the President, in introducing him to the audience, had alluded to the fact that the Metropolitan Gas Company of Melbourne had subscribed its full quota to assist the Committee at home, and said that, by so doing, they had done more to encourage the initiators of the movement than any other factor that had occurred. It had been the means of getting co-operation from other companies in England who had not previously come into line. The President praised the action of the Metropolitan Gas Company very highly indeed. He (the speaker) quite agreed with Mr. Mitchell that if members wanted to push gas to its full limits, they would do well to advertise. He did not know whether they had the power to form a separate Gas Publicity Committee. It really required a great deal of expert knowledge. They wanted also an expert advertiser—a highly paid man to formulate advertisements to appear full page in all the public papers. He thoroughly believed in the idea. If a Committee were formed, it would, of course, receive all the information and any matter issued by the English Gas Publicity Committee; and the Committee of the Association would adapt it to local requirements. This would be a good thing. Was it Mr. Mitchell's opinion that it would be advisable to have a small Committee?

Mr. MITCHELL said he had not formulated anything, having merely wished to raise a discussion and leave the matter in the hands of the Council. But he had thought that it would be necessary that a local Committee should be formed, and that it should be composite, containing not only gas men, but contractors for gas appliances in relation to heating and lighting. These points he would leave in the hands of the Council to settle. Meanwhile he would move—"That the advisability or not of forming a Gas Publicity Committee, and the composition of the Committee, be left entirely in the hands of the Council.

The Hon. GEORGE SWINBURNE seconded the motion.

The PRESIDENT, in declaring the motion carried, said he had no doubt the Council would go into the matter and let the members know what could be done.

IV.

"Are gas-fans extensively used, and do they give satisfactory results?"

V.

"What methods could be adopted to further the interests of a gas company? Is it advisable to introduce a system of free maintenance for stoves and incandescent burners?"

Mr. AIRD (Townsville) said he had tried gas-fans, and he was sorry to say they were not satisfactory. The heat generated by them in a small room more than counteracted the benefit obtained. Fans looked very nice in the shop windows, with a few gay ribbons blowing about in the wind they made, making the place look cool; but one did not feel cool near them. As to Question No. V., he did not know that it would be advisable to introduce a system of free maintenance for stove and incandescent burners. It might be all very well for a small company. As to the best method of furthering the interests of such a company, the first thing to be done was, he thought, to do the best one could for the consumers. It behoved a gas manager to make a good clean gas, sell it as cheaply as possible, and educate the consumers as to the best method of burning it. When he first went to Townsville a few years ago, there was only one gas-stove in use; whereas now there were thousands. In fact, he had been told that the town was the third largest buyer of gas-stoves in Australia, and came next to Melbourne and Sydney. This was a great thing, because Townsville had only 20,000 inhabitants; and it was due, he considered, to the attention his men gave to consumers. They charged a small fee, which practically went to the maintenance of the stoves. As to incandescent burners, they maintained them in good order at 6d. each per month. He employed four men to do nothing else but attend to the burners; and he considered this was one of the causes of the great success of his Company. He used the word "success" because during last year the consumption of gas had increased 12 millions on 56 millions, which was practically 30 per cent. Through the proper maintenance of burners, gas was burnt to the best advantage, giving the consumers satisfaction; consequently there was less likelihood of opposition. Maintenance at Townsville included keeping the burners clean, and the providing of rods, mantles, and chimneys. All other work was charged for.

Mr. C. W. HOWLETT (South Melbourne) said he could endorse the remarks of Mr. Aird. He had had the pleasure of visiting Townsville, and saw the gas lighting there, and it was very fine. The attention given to consumers was great, and the assistance afforded them at night by the Company was very generous. He had been told by many business people of Townsville that they were quite satisfied with the attention given to them by the Gas Company, and did not want any opposition to come forward.

Mr. S. E. FIGGIS (Ballarat) said he thought Mr. Aird was on the right track, for he was carrying out the method which was practically the same as had been adopted in Ballarat; and the people expressed themselves as very well pleased generally.

Mr. L. RODGERS (Warrnambool) said, in regard to gas-fans, he had not been very much struck with the Brock fan. It appeared to be a rather crude thing, and was very noisy. It also seemed to generate a certain amount of heat. Electrically inclined people were always asking gas managers to give them a fan during hot weather; and he thought a water-power one would be useful.

Mr. BEARUP (Stawell) said, as he had made the inquiry as to fans, he had to thank Mr. Aird and Mr. Rodgers for the information they had given him. There were people travelling about the country whose speciality was fans; and if they could run fans, he thought gas companies ought to be able to do it.

Mr. HUMPHRIES (Hamilton) said he had been most unfortunate through having, ever since 1894, to combat with electricity. As to free maintenance, at Hamilton, they had between 80 and 90 lamps which were regularly attended to free—globes and burners being cleaned, but renewals charged for. He thought it was partly owing to the attention given to the lamps that they had been able to secure the borough lighting for the next five years.

REMODELLING A SMALL GAS-WORKS.

By L. RODGERS, of Warrnambool.

[A Paper read before the Victorian Gas Managers' Association.]

With the successful introduction of gas-cookers and other modern gas appliances in Warrnambool, the demand for gas increased so rapidly that in 1909 it was found necessary to make several alterations and extensions in the manufacturing plant.

The condensers (5-inch vertical), exhauster, and scrubber, were all within a few feet of each other; and, having practically no foul main, we were continually having trouble with the exhauster getting fouled, and a considerable amount of tar was going forward as far as the purifiers. I brought this matter before my Committee; and, being sanguine as to the future prospects of the town, I advised them to remodel the whole works so as to make the plant capable of manufacturing and dealing with at least 20 million cubic feet per annum. The annual output at that time (1909) was 10,700,000 cubic feet; while for the twelve months ending Sept. 30 last the gas made was about 16 millions.

After an exhaustive inquiry as to the relative merits of gas and electricity, the Town Council decided to go on with the extensions; and, having had a consultation with Mr. S. E. Figgis, the Engineer of the Ballarat Gas Company, who submitted a report on the requirements of the works, I made a start in January, 1910, by putting in an 8-inch cast-iron foul main, 150 feet long, around the inside of the retort-house, with a 5-inch temporary connection to the old condenser; the tees at the angles being all fitted with blank flanges for inspection purposes. This main is carried on pieces of steel rail, one end of which is let into the wall, and the

other end supported by two flat bars suspended from the roof principals. Part of the main is laid with a fall-back to an 8-inch by 6-inch T near the hydraulic, so that, in this portion, the tar, &c., flows the opposite way to the gas, but the remainder of the main has a good fall to the top pipe of the new condenser.

When the new foul-main was connected-up, it had the immediate effect of reducing the tar trouble very considerably; and I believe that wherever these mains are installed they are of great assistance to the condensers.

Following the completion of the foul-main, the next work undertaken was the erection of a horizontal condenser (Graham's type), consisting of five double rows of 8-inch pipes, a new rotary exhauster and gas-engine, and also the fitting-up of a tar-washer which had been lying idle for some years.

One reason for choosing the horizontal type of condenser was that, if it eventually became too small, the pipes and castings could be made use of for other purposes; and another reason was that it it is a simple matter to erect a roof over this form of condenser if necessary to protect it from the extremes of heat and cold.

From the condenser the gas is conveyed underground a distance of 90 feet to the exhauster house, where the new exhauster is installed with the old one fixed alongside, and five 8-inch valves so arranged that either one can be shut-off while being overhauled. I had a good deal of trouble with the exhausters until I tried tar oil for lubrication, which I find very effective.

A temporary 5-inch connection was made from the outlet of the tar-washer to the inlet of the old scrubber. The latter has since been removed and replaced by a new steel one, 25 feet by 6 feet, which is packed with wooden grids having ½-inch spaces; each row being separated by two rows of 1½-inch battens—a space being left at the bottom with a manhole for clearing pipes, &c. A butterfly sprinkler is inserted through a 3-inch hole in the top plate, and is screwed on to a short pipe tapped into a 12-inch cast-iron flange resting on the top plate and held in position with weights. The sound of the sprinkler as it revolves can be heard from the outside; and should it fail to work it can easily be removed by disconnecting a union and lifting it out.

After the renewal of one of the two beds of fives now in use, an old bench containing three beds of threes (direct fired) was pulled down, and a new bench erected in its place, containing three arches with cellar and steel charging floor. Two of the arches were built in with regenerative settings of five and three retorts; and the remaining arch will eventually accommodate six retorts. The new retorts are fitted with a mouthpiece at the back end for scurfing; and the walls of the regenerator are built up of triple bricks with baffle stops in between. Two secondary-air shutters are provided—one controlling the front and the other the back half of the setting; the secondary air being finally heated up by having to pass through three rows of horse-shoe blocks laid over the producer arch, which, with the arches in the combustion chamber, are composed of Ewell bricks. This material, after being in continuous use for over 7½ years in a setting at the local works, was as good at the end of that time as on the day it was put in. The two old settings are similar to the new ones, with the exception that the regenerator has only two waste-heat flues, which are built-up of plain bricks. The hydraulic main is carried on steel joists, and is divided into three sections—one for each bed, with 6-inch weir-valves and 2-inch tar-pipes. When removing the tar out of the hydraulic mains, the town supply water is allowed to run in as fast as the tar flows away to the tar-well. But another method I have thought of trying is to connect all the tar-pipes into an air-tight tank on the floor level; then to fill the tank with liquor; and turn on the tar-taps and let the tar take the place of the liquor in the tank. This arrangement would admit of hydraulics on different levels being kept free from tar with one tank by connecting the latter to different sections alternately. This tank or cylinder would be practically part of the hydraulic main for the time being; also it would not interfere with the height of liquor regulated by the weir valve in each section, as may be the case when using the tar-tower.

I would strongly recommend any manager, when considering extensions in the retort-house, to go in for settings similar to the above; also to have the hydraulic main in sections supported on steel joists, instead of on brickwork.

As our purifiers are worked by a centre-valve—three on and one off—I have not been able to try the rotation method of changing. But I find it a good plan to have two charges of oxide spread out in order to give the material more time for revivification; and I also find it beneficial to put a layer of breeze on the lower grids.

The old station meter, which had only 4-inch connections, has been replaced by a new one having a capacity of 8000 cubic feet per hour with 8-inch connections. New 8-inch mains have also been laid from the outlet of the purifiers to the 9-inch main leading to the town; the valves and connections being so arranged that the town can be supplied from any one of the three holders independently of the others.

A new two-lift gasholder of 100,000 cubic feet capacity was erected last year; but as the only available space at the works was in swampy ground, it had to be built some distance away. The tank for this holder has a concrete bottom; the sides being composed of local sandstone rendered with cement and backed with sand between the wall and the face of the excavation, which is all solid sandstone to within 6 feet of the top of the tank—this portion of the wall being strengthened with two iron bands. The guide-framing is all steel; the standards—twelve in number—being H section connected together with two rows of channel irons and diagonal tie-rods. This framing, although somewhat plain looking, has fewer corners and joints where the rust can accumulate than the lattice girder type. Inlet and outlet pipes, 12 inches in diameter, are fixed at right angles to each other in dry wells, and are fitted with 12-inch valves, so that this holder can be shut off and the town supplied through a bye-pass from one of the holders at the works; the pressure being controlled by a new 12-inch governor on the outlet main of the new holder. To connect up the holder with the town supply main, it was necessary to lay 8¼ chains of 9-inch pipe to the inlet, and a 12-inch and 10-inch pipe from the outlet back to the supply main—suitable castings being left for future extensions.

In passing, I might mention a good wrinkle I have come across for running lead joints in mains, which is to get a piece of plaited asbestos packing, about an inch in diameter, and soak it in a thick solution of clay. This material adheres well to the pipes, and ensures the making of a very neat joint.

In conclusion, I might say that my object in writing this paper is to create a good, animated discussion on gas manufacture generally, and at the same time give members an opportunity of relating their experiences with different types of gas-making plant.

DISCUSSION.

The President (Mr. J. W. Thompson) said the members ought to be very pleased with the paper contributed by Mr. Rodgers. The communication was both interesting and suggestive, and should cause a lot of discussion.

Mr. P. C. Holmes Hunt (Melbourne) supplemented the President's congratulation to Mr. Rodgers. The author ought to be congratulated that, in conjunction with Mr. Figgis, he had brought about a complete reorganization and reconstruction of the Warrnambool Gas-Works. Apparently the works needed it very badly; and that some extension was necessary would perhaps be shown by the figures relating to the consumption of gas, which had, apparently, been advancing by leaps and bounds. He should think that the increase mentioned, if not a record, must be among the very highest increases for towns in Victoria. A point that struck him as Mr. Rodgers was reading his paper was the arrangement for running-off the tar and liquor. It appeared to be specially applicable to hydraulics on dead-levels. Mr. Rodgers had referred to hydraulics on different settings—namely, settings which had been built at different periods on different sites. He thought one of the greatest ills in a retort-house was to have hydraulics on different levels. If the hydraulics were not at a level, it was impossible to work in a modern way (with a tar-tower) satisfactorily, and get the best results. It was certainly one of the greatest axioms in a gas-works to keep the hydraulic mains level. Members would naturally ask what were the results of the reconstruction of the Warrnambool works? He was sure they would like to hear from Mr. Rodgers what were his carbonizing results and what generally was the benefit that had been derived from wholesale reconstruction.

Mr. H. V. Mitchell (Brighton) supported some of Mr. Hunt's remarks regarding the necessity for hydraulics being at one level. In conjunction with this, it was, he said, even more essential that the bottom of the dip-pipes should be absolutely level right through the house. It was worth while struggling for a few days to get the dip-pipes within one-fifteenth of an inch of being level; and the nose of the dip-pipes should all be chamfered, wherever this was possible.

Mr. E. Tipper (Box Hill) said that, so far as the retort-house was concerned, he saw no particular reason why all the hydraulics should be on one level, so long as each section of hydraulics was perfectly level. It did not matter if there was a difference of a foot between section and section. Each section might be fitted with a separate tar-column which would cover the seal in the particular section to which it was attached. At Box Hill he had three sections of hydraulics, each a particular height from the floor-line; and each section had its own separate tar-column. He quite agreed that it was most important that each section should be level from end to end. Given this and making the dips level and bevelled, as suggested by Mr. Mitchell, one would get the best results. Placing the hydraulic floats on the top of the sealing liquid would give very gratifying results. At Box Hill, the hydraulic mains were very small—being only 13 inches at the sealing point of the dip. Therefore he got a tremendous wave-action when charging the retorts, and a belching in the ascension pipe. Since adopting floats, he had found the belching was practically overcome, and he had been enabled to get down to a much finer seal. Of course, the seal must be governed by the area of the dip-pipe and the area of the hydraulic, and what was likely to be the maximum pressure to be carried under certain conditions. Mr. Rodgers said that he had found very good results from putting breeze into the purifiers. Before coming to this point, however, he noticed that Mr. Rodgers had succeeded in extracting all the tarry matter from the gas before it reached the purifiers. If Mr. Rodgers had done this, he failed to see the advantage of putting in absorbent matter at the bottom of the purifiers. Breeze, clinker, or ashes had no value as a purifier. It seemed to him a waste of valuable space to put either where oxide or some other purifier should be found, if one had succeeded in taking out all the tarry matter. Towards the end of the paper, Mr. Rodgers spoke of dry wells in connection with the inlet and outlet pipes of his new

holder. He (Mr. Tipper) thought if he were designing a gas-holder, he would not put in a dry well, although he knew it was the common practice to do so, as it gave one an opportunity of examining and probably remedying any defect in the inlet and outlet pipes. But if the cost of a dry well were calculated as against the cost of inlet and outlet pipes of large diameter, with the sealing ring inside the crown of the holder, the balance would be in favour of the latter and not in favour of the old-fashioned system of a dry well.

Mr. F. TIPPER (West Melbourne) said it struck him that, as one reason for choosing horizontal condensers was mentioned, he would like to know what the other reason was. Would Mr. Rodgers tell the meeting?

Mr. A. NEIL (Footscray) sympathized with the author on the difficulties he had had in Warrnambool. He thought Mr. Rodgers had managed very well indeed. As to the breeze and the oxide on the bottom grids of purifiers, he regarded it as a very good idea. He had tried the experiment at Dunedin; and in nine cases out of ten, when the purifiers were recharged, he put breeze on the lower grids. It had a tendency to keep the oxide from passing through into the bottom of the purifiers; and at the same time, if there were any tarry matter passing through the grids, it was absorbed in the purifiers.

The PRESIDENT was not sure whether breeze alone was put on the bottom layers or whether it was mixed with the oxide. The meeting would like to know what results Mr. Rodgers got from his reconstruction work at Warrnambool.

Mr. RODGERS said that not much benefit had as yet resulted from the new plant, so far as carbonizing returns were concerned, because they were still using the old semi-regenerative settings, one of which was in rather a bad condition just now. But he was hoping to get a new one shortly. The average make of gas per ton of Aberdare coal was 11,700 cubic feet. There had been a large demand for coke in Warrnambool last summer, and they could not supply it. If the suction gas people were not kept going, there was a danger of their getting charcoal or other fuel, and the gas company would not get them as customers again. A beneficial result had been convenience in working; the plant, previous to the alterations, being altogether too small. There had been a lot of delay in getting the new plant into operation; but he hoped to reap the benefit of the new settings by very considerably increasing the results derivable. Regarding the use of breeze in the purifiers, he thought it assisted in preventing the oxide from getting hard, and it also absorbed the moisture. Of course, no tar at Warrnambool now got as far as the purifiers. The breeze was not mixed with the oxide, but simply used in one layer on the bottom. It was found much more beneficial than when tar was going forward. The other reason for using horizontal condensers which he had not mentioned was that they were easy to run over; and, for works of small size, they worked very satisfactorily. For the last twelve months the sales of coke amounted to 9½ cwt. per ton of coal carbonized.

Mr. F. W. SUMNER (Wangaratta) heartily congratulated Messrs. Rodgers and Figgis on their scheme of remodelling the Warrnambool Gas-Works. He was particularly struck with the capacity of the gasholder. In the majority of small works, the storage capacity seemed a big drawback, and was much against economical working. He was certain Mr. Rodgers in future ought to be very happy from this point of view.

Mr. RODGERS (in reply to the President) said he principally used engine coal with a lot of slack.

Mr. W. AIRD (Townsville) said, in reference to breeze in the purifiers, he had had a little experience. He had built a reinforced cement purifier, and he placed 2 feet of breeze in the bottom on the grids. It lasted until the purifier got fouled; and he found it very good. The breeze was afterwards used under the steam-boiler for fuel. It was not wasted, and it saved the purifier. It was well known that the breeze was not used for purifying; but it took out the dirt and other matter, and prevented such things getting into the purifiers.

The PRESIDENT said Mr. Rodgers had evidently silenced members by his large make of gas per ton, which seemed to have taken the wind out of everyone's sails. It was really a wonderful make; and he did not think many country works using ordinary coal could approach it. Exceptionally good coal must be got to average such a splendid make of gas as that named by the author, for any length of time.

Mr. RODGERS, in reply to Mr. Figgis, said his unaccounted-for gas was about 7 per cent.; and, in reply to Mr. Hunt, he stated that, although he could not tell exactly, he had a big mileage of mains. Warrnambool was a very scattered town and mains were as a rule laid on both sides of the street. He had lost a considerable amount of gas through the erection of the new holder and main-laying, &c.

Mr. E. TIPPER: With 9⅛ cwt. of coke sold per ton of coal carbonized, it would be interesting to know what was the average yield per mouthpiece per 24 hours.

Mr. RODGERS said there were ten retorts in use for the twelve months, and close on 16 million cubic feet of gas were made. The amount of coal used was 1447 tons.

Mr. K. C. BEARUP (Stawell) said one or two of the speakers had made remarks in regard to oxide and breeze. Members of the Association for some years would recollect that in 1908 Mr. J. Lord, of Williamstown, read a paper on the purification of gas, in which he recommended that half breeze and half oxide should be placed in the purifiers. They knew that very small works had no exhausters to take the pressure off; and the mixing of the oxide with fine breeze assisted a good deal in keeping down pressure. In regard to the butterfly spreader in the washer, he remembered once having one to spray the gas; but the action of the ammonia ate the connection away, and consequently he had to discard the spreader.

Mr. J. CARTER (Grafton, N.S.W.) said, with reference to Mr. Rodgers' return of gas per ton, he might mention that in Grafton his make averaged 9000 to 12,000 cubic feet, and he had got as much as 12,400 cubic feet. Only he doubted whether, when the make reached this figure, he could depend on the coal measurements. In consequence of uncertainty about the weight of coal, he now checked all the coal as received. Sometimes his unaccounted-for gas was very heavy. He did not know whether members were aware of the condition of the streets at Grafton. Great jacarandas, bunya-bunya, and Moreton bay figs were planted in the streets; and the roots got all around the gas-pipes, which were in consequence often broken and a lot of gas lost. His output was 12½ millions per annum. Mr. Rodgers had provided probably for a very rapid increase in consumption in his district. He (Mr. Carter) took charge of the Grafton works seven years ago; and he had already increased his output something like 30 per cent. In a more progressive country town than Grafton, it might be different. He might be wrong in thinking that Mr. Rodgers had overstepped the mark in going for such a large area of gasholder.

Mr. C. W. HOWLETT (South Melbourne) said that, after an exhaustive inquiry as to the relative merits of gas and electricity at Warrnambool, it was a matter for congratulation that gas had been able to hold its own, and that the money had been spent in gas improvements. When a gentleman like Mr. Figgis took figures in hand, he could prove to many laymen the superiority of gas. No doubt some towns were behind in gas matters and would not spend money that was necessary to put things right; but when people were open to reason, and the matter was gone into exhaustively, it could be shown that a satisfactory return could be got from a judicious outlay.

Mr. W. PAIN (Bendigo) congratulated Mr. Rodgers on his excellent results in respect of sales of coke. He would like to know whether it was dry coke, or was it coke as it came out of the retort-house?

Mr. RODGERS said it was dry coke mostly, and it was sold as a rule over the railway weighbridge.

Mr. PAIN considered that Mr. Rodgers had got a very high result from so small a retort-house. Mr. Rodgers' gas yield was also very high. At Bendigo, he had got 12,400 cubic feet per ton of old; but with the coal they were now using, he could not get near this amount, and neither could he get good results in the matter of coke.

Mr. H. R. CARR (South Melbourne) sketched on a blackboard and explained his method of automatically removing tar from the hydraulic main. Tar on being formed falls to the bottom of the main owing to its specific gravity—the weight of water in the main forcing it through a junction pipe which is in connection with the bottom of the hydraulic main, and having its outlet into the gas off-take pipe and thence to the tar main by means of a drip pipe. The main tar-pipe is also in connection with the bottom of the hydraulic main at a point where the junction pipe meets it; and a valve is provided at this point in case of stoppage and for flushing. A weir-valve is provided on the gas off-take pipe between the gas outlet from the hydraulic main and the point where the junction pipe meets it. This serves the double purpose of a gas-valve and a means of regulating the amount of seal on the anti-dip valve. The foul main is connected on the top of the gas off-take pipe, out of the way of any tar from the hydraulic. Water may be supplied to the hydraulic by means of a self-sealing U connection.

The PRESIDENT moved a very hearty vote of thanks to Mr. Rodgers for his trouble in preparing the paper he had brought forward, and also for the manner in which he had answered the questions put to him.

The motion was duly seconded and carried unanimously by the members.

American Gas Institute Meeting.

The time is rapidly approaching for the annual meeting of the American Gas Institute, which will be held at Richmond (Va.) from the 15th to the 18th prox. The list of communications to be submitted shows that there will be matter at the meeting of importance to all branches of the profession. In addition to a report of the Committee on the Utilization of Gas Appliances, the following papers are to be read: "Gas Rates," by Mr. Alten S. Miller. "Protection of Street-Mains by an Adequate System of Inspection," by Mr. C. C. Simpson, jun. "Organization and the Equipment for, and the Method of Handling, Street Leaks," by Mr. Alan D. Whitaker. "Protection of Street-Mains by the Intelligent Use of Underground Space," by Mr. G. I. Vincent. "The Installation of Mains and Pipe-Lines of Steel and Wrought Iron," by Mr. H. L. Rice. "Closer Relationship between the Engineering and Commercial Departments," by Messrs. C. N. Stannard and F. Q. Cannon. "The Portable Electric Photometrical Standard: Its Construction and Use," by Messrs. A. H. Schaaf and Clayton H. Sharp.

LIQUID, SOLID, AND GASEOUS FUELS FOR POWER PRODUCTION.

Before Section G (Engineering) of the British Association last week, a discussion on this subject was opened by Professor F. W. Burstall, of the Birmingham University, who presented a communication in which he said that the general problem of power production was one of the most fascinating subjects for all engineers; and he proposed to consider some of the means by which carbonaceous substances may be treated to render them suitable for the production of power. The fuel of the world consisted of two forms—liquid and solid—which were really closely related, inasmuch as both consisted of compounds of carbon and hydrogen together with small percentages of other substances, such as nitrogen.

Most engineers looked upon coal purely from the point of view of fuel to be used in a furnace for the production of heat. It was, however, a complicated substance from which could be extracted a wide range of valuable products in addition to its worth for the production of heat. It was often assumed that the oil-engine in one of many forms was likely to be the heat engine of the future; and at first sight there was much to be said for this contention. For the heat engine, as a thermodynamic machine, oil was immensely superior to either solid or gaseous fuels, because of the high heating value and from the ease in which it can be introduced into the working fluid.

Putting steam on one side, the problem was to heat-up a mass of air confined in a cylinder. It was soon found by Stirling and many others in the early part of the Nineteenth Century that it was extremely difficult to rapidly heat up a mass of air by conduction through a metal plate; the only feasible method being to mix the fuel with air, and ignite them in the cylinder. In order to ensure the complete and rapid heating-up of the air, the mixture must be as intimate as possible, which was, of course, readily and simply obtained with a gaseous fuel; but there were points in the use of gaseous fuel which led to serious difficulties.

In order to secure efficiency, the main mass of the air must be heated by compression before the principal heat supply was added. The combustible gas might be added before compression began, as in the well-known Otto cycle; but this introduced the possibility of the charge igniting before the correct time. It also required that the gas should be free from any liquid or solid substances—a state of affairs not easy to obtain on a large scale. If the gas was compressed by a separate pump, there was a certain loss of heat, due to necessary cooling of the pump. These inherent effects of the gas-engine would probably prevent it ever being made in sizes which approached the steam-turbine. With a liquid fuel there was no difficulty in forcing the small amount of oil required into the preheated air, and the oil was readily freed from foreign matter; also there did not appear to be any inherent reason, beyond those of weight and cost, why the oil-engine should be made in the largest sizes, where it must always be inferior to the rotary machine. There remained now to be considered the question of the gas-turbine.

It could readily be shown that the velocities which had to be dealt with were no greater than those encountered in the steam-engine; but there were some difficulties which, in spite of innumerable efforts, had so far proved insurmountable. The greatest defect was that, so far, it had not been found feasible to compress the air and gas in the turbine itself. Separate compression considerably increased the losses; so that, in place of the negative work being one-third of the gross work, it would probably be at least one-half, and perhaps more. The cooling of the rotating disc and blades offered difficulties; and, so far, no material had been found that could withstand the erosive effect of the burning gases. It seemed very doubtful if the gas-turbine could be constructed to compete with the reciprocator on the present state of knowledge.

It was important to consider the amount of various fuels raised in different parts of the world. At present, 1,200,000,000 tons of coal of various kinds were brought to the surface every year; crude oil amounted to about 50,000,000 tons per year; and it was doubtful if there were any large oilfields yet to be discovered. It therefore followed that the supply of oil was totally inadequate in amount to replace coal for power production on a scale equal to the present steam-power production.

The artificial production of oil was at present being considered seriously by engineers, and there was little doubt that much yet remained to be discovered in this field. Every engineer was familiar with the fact that when coal was heated in a closed retort gas and tar were given off; also that the higher the temperature at which gasification took place, the greater was the yield of gas, and less tar was formed. Tar, when distilled, gave a number of valuable substances, but only a small fraction of light oils; and the middle oils suitable for the Diesel motor contained some crysilic acid.

Up to the present, coal has been gasified with the object of making the highest yield of gas. It was, however, quite possible to alter the conditions of carbonization so as to obtain a high yield of fuel oils and other compounds of value as a side-issue. But an important one was sulphate of ammonia, the use of which as a manure was steadily increasing in all countries of the world. Sulphate of ammonia was the most valuable manure where nitrogen was needed; and it was one of the greatest defects of the crude burning of coal that such enormous amounts of nitrogen were not only wasted, but turned into nitric acid in the atmosphere. Of course, the nitric acid was returned to the soil by the agency of rain, but not necessarily where required by the cultivator.

Dealing with the fuels which may be utilized for the production of power, it was pointed out that gas power can be obtained in the following ways: (1) Town gas made in closed retorts; (2) producer gas made by blowing air and steam into incandescent fuel; (3) gas from coke-ovens, where the production of hard coke is the primary aim. For one ton of coal gasified in a modern gas-works, 11,500 to 12,500 cubic feet of gas were obtained, having a calorific value of about 550 B.Th.U. per cubic foot, and also about 10 gallons of tar and 25 to 30 lbs. of sulphate of ammonia. The gas had to be purified for domestic purposes; also a gas-works had to be near a great town, where the working expenses were not so low as in a more rural part. For these reasons it was doubtful if town gas could be supplied in present conditions for much under 10d. per 1000 cubic feet. A good gas-engine and dynamo gave one kilowatt-hour for 20 cubic feet of gas—*i.e.*, at a fuel cost of 2d. per kilowatt-hour, which of course was too high for large-sized units.

Despite these facts, Professor Burstall said he held the opinion, after mature consideration, that the whole problem of fuel treatment would lie in the direction of heating the coal, peat, or lignite in a closed retort, not of necessity under the conditions which were at present forced on the gas-works, where the primary object was to produce an urgent yield of gas on a certain standard laid down by Parliament. If it be granted that the quantity, quality, and purity of the gas produced were secondary matters, the problem of fuel treatment became one of the most fascinating which the engineer could encounter. It had long been known that the quantity and quality of the tar were largely influenced by the temperature at which the fuel was carbonized—the lower the temperature the better the tars in both yield and composition. The amount of sulphate of ammonia recovered from the gas was only 25 to 30 lbs. per ton of coal, whereas the amount of nitrogen present in the coal would give about 120 lbs. of sulphate of ammonia in the ordinary process of carbonization—*i.e.*, some three-quarters of the nitrogen was left behind in the coke. Under present conditions this could not be avoided, but improvements in this direction were possible. If the gas and tars were withdrawn from the heat directly they were evolved from the coal, a set of products would be obtained of a different composition from those usually obtained. Many of these oils could, after distillation, be employed as fuel oils for power production—both the light oils, such as benzol, pentane, and hexane, and middle oils, such as crysilic acid—while the heavy oils of the anthracene series appeared to be of value for lubricating purposes.

Professor Burstall outlined a scheme of fuel treatment which, he admitted, was at present wholly beyond the region of practical realization. The first step was to obtain a coal field of wide extent, yielding a coking coal. It need not be within a short distance of towns, as that would merely modify the means of transmission; the essential point being to obtain a sufficient supply of coal to enable the capital charges being repaid in a series of years—probably thirty. The works would have to be on a large scale to enable the economy of working that always results from wholesale production, but the carbonization plant would be placed near the pit-head, so that the tubs could discharge direct into the bunkers of the retort-charging machines. A very convenient size for each plant would be about 2000 tons per day, and there would be some five to six pits operating over quite a large area. There would be no gain from any point of view in not shipping direct from the pit-head the coke and sulphate of ammonia, as these would be ready for market without further treatment. Tar and gas would be taken for future treatment by pipe lines to suitable points depending upon geographical considerations. The tar from the whole of the works would be passed through continuous and automatic stills, where the various fractions would be obtained with the least expense. The fractions, after working with acid and soda, would pass to a second set of automatic stills; this process being continued until the pure products ready for the market were obtained without the necessity for storage, and in the least possible space of time. As to how far the treatment of residuals should be carried, no definite answer could be given, as it depended on current prices. But on the scale considered—viz., 120,000 to 140,000 gallons of tar per day—it would certainly be advantageous to treat the products to a finish.

The portion of the gas not required for firing the automatic stills and for colliery purposes generally would be led to a different point, perhaps many miles from the pit head. This offered no difficulty as regards the power required, the great obstacle being the cost of the pipe line, which might, to a large extent, be reduced by gasholders at the delivery end, so as to improve the load-factor on the pipe line. The gas would be free from tar, but would contain sulphur compounds. It would be employed in gas-engines for the generation of electricity, which would be sent at high voltages not only to the towns, but also to the railways, which were supposed to be entirely electrified. No doubt electrical engineers would look askance at gas-engines, not only for the many failures that had occurred with large units, but also because at present some 2000 H.P. was the largest size that could be built; whereas a steam turbine could be constructed to give an output of 20,000 kw. at a low first cost. The gas-engine could only compete with the steam turbine when its fuel gas was delivered to it at a price which would, when helped by its high thermal efficiency, enable it to get over its large capital outlay. But perfect as was

the steam turbine as a mechanical machine, its thermal efficiency was half that of its rival, as the cost of the steam delivered to it could not be reduced, seeing that the margin of improvement possible in the boiler was small. There were also no bye-products, as the whole of those contained in the coal were used to pollute the atmosphere.

For these reasons it was quite possible for the gas-engine to produce current more cheaply than the turbine. But the price of gas of a calorific value of 500 B.Th.U. per cubic foot would have to be 4d. per 1000 cubic feet if coal were taken as 20s. per ton. This would give for each fuel about 125,000 B.Th.U. per penny; and, taking the gas-engine as two-and-a-half times as efficient as a turbine, this should leave enough margin to compensate for the increased capital outlay. The exhaust gases would be washed so as to extract the sulphuric acid, which would be returned to the pit head for the manufacture of sulphate and the washing of the tars; so that all the external material to be purchased would be the soda ash used to neutralize the excess acid. In this manner the whole of the products of the coal would be recovered in a form ready for the market; and, if the coke were used as a domestic fuel, a smoke-laden atmosphere would be impossible.

Producer gas for power and heating purposes had a large field in front of it, particularly when the factory was distant from the coal field, and also where there was a steady load. In producer gas the whole of the fuel was converted into gas and tar, so that a large quantity of gas, 120,000 to 140,000 cubic feet, could be obtained per ton of coal. The ammonia yield was very high, being from 80 to 90 lbs. of sulphate per ton. The calorific value of the gas was low—about 140 B.Th.U. per cubic foot; and the tar was small in quantity and poor in quality, as it was nearly all pitch. The low calorific value and the difficulty of cleaning the gas were serious drawbacks to the transmission over long distances. In South Staffordshire, however, producer gas had been piped over a wide area for several years, and the undertaking now appeared to be on sound financial ground. The suction producer working on coke or anthracite coal had a very definite position for small plants in remote districts, where it formed a cheap and reliable source of power.

The propulsion of ships by internal combustion engines was one of the most important problems of the near future. The gas-engine itself offered no special difficulty; but to instal a producer plant of large size did not appear to be possible for the following reasons: The space taken by the producer alone was large, and in addition there was the cleaning plant; again, when the percentage of the poisonous carbon monoxide was high—15 to 20 per cent.—the plant should be entirely in the open air to prevent risk of gassing. These conditions were most difficult to fulfil; and, now that the Diesel motor had proved itself suitable for marine propulsion, the more cumbersome and dangerous producer would be discarded.

Taking the question of producer gas as a whole, it would seem as if it would always have a definite use, but only a limited application, more especially in a country like Great Britain, where in time it would be possible in almost every part to obtain electricity cheaply in bulk. When this was the case, no other source of power need be considered.

The case of coke-ovens really fell into the same class as the retorted gas; the only difference being that to obtain coke capable of carrying the weight of the iron in the blast-furnace, the temperature of carbonization must be high (1200° C.), and the period long (24 to 30 hours). Thus the tars were poorer from being more split up, and the cost of repairs to ovens was considerably higher than on a gas-works retort. As hard coke must be made, the place for it was in conjunction with the ordinary plant, so that the bye-products might be readily worked up.

In conclusion, Professor Burstall remarked that there was no real rivalry between gas and electricity when they were viewed from a broad standpoint; both took their origin from coal, and each was capable of doing things that the other could not. The work of the engineer was to consider them both, and to see if he could not, by marrying the two together, obtain from the coal more products useful to man than by shutting his eyes to merits in any subject outside his own studies and experiences.

Mr. W. M. Mordey said that Professor Burstall had held out little hope that the gas-turbine would be a practical tool in the near future; but there was one solution which occurred to him—viz., the adaptation of the Humphrey gas-pump with a water turbine, allowing the water to drive a dynamo. The overall efficiency of the Humphrey pump in water-horse-power was said to be something like 30 per cent., which was enormously high; and if the pump could be used in conjunction with a water-turbine which had an efficiency of about 85 per cent., an overall efficiency of the combined pump and turbine of 25 per cent. would be obtained. Such a solution would very much simplify the problems now presented by the gas-turbine, and provide at the same time direct means of driving a dynamo by a simple rotating motor. The proposal had been made before; but he did not know to what extent Mr. Humphrey had followed it up. This method would give an efficiency as high as any large gas-engine would give in continuous work, and in a much more simple manner.

Dr. J. S. Owens, dealing with the suggestion of the carbonization of coal at high temperature in order to get all the possible bye-products, said that this produced a coke which was unsuitable for domestic use. Coke would not burn well unless there was a certain amount of volatile matter left in it; and such coke gave a very unpleasant looking fire. With reference to the loss of nitrates from coal, recent experiments on the deposit in London had shown that the soot and dust falling on a given area measured in three or four places in the City was six times as great as in the suburbs. The total deposit was 500 tons per square mile per annum. On the general question of the utilization of oil, gas, or solid fuel, we were apt to forget that very much of the prosperity of England depended upon the utilization of its coal supply; and it seemed to him that we should almost eliminate—except as an academic question—the utilization of oil other than the oil derived from our own coal, because otherwise we would be cutting our own throats.

Professor T. Hudson Beare said that, from what he knew of the work now being done in the direction of using the internal combustion pump with a water-turbine, he believed there was a great future for this type of motor for power purposes. He heartily agreed with Dr. Owens that Great Britain should depend for its power upon its coal resources. There were few British oil areas available. It was true that there were the Scotch shale deposits; but after all, these produced only a very small quantity, and even the oil deposits in Burmah (and possibly Australia and New Zealand) would only yield a very trifling amount. Consequently, from the Empire point of view, we should look to the question of the utilization of our own fuel, and that was coal. The matter had been brought to his attention by a conversation with a shipowner, who had remarked that it was all very well to talk of Diesel engines; but British shipowners wanted to be able to use a fuel which lay at our doors, and this could only be coal. There was, therefore, a great future for an oil fuel for use on ships which was primarily derivable from coal.

Professor Burstall, in winding up the discussion, said he had not said anything about the Humphrey pump, because he did not think it could be made in sufficiently large sizes to warrant any application of the sort suggested. With regard to the coke mentioned by Dr. Owens, he did not wish it to be assumed that the method he had indicated would be the same as that now employed in gas-works. Gas-works were at present terribly handicapped, and did not do what they could if they were free from Acts of Parliament which saddled them with penalties not imposed upon any other industry. If the coal were burnt in a retort at a temperature of 800° to 1000° C., and means were taken by which the gas and tar were at once removed from the front, they got a substance which was quite unlike gas coke, because gas coke was usually quenched in water—a procedure which was quite wrong. If the coke were placed in a closed vessel and cooled by conduction alone—somewhat on the Montreal system—a coke would be obtained which would burn perfectly and which would give a very bright and clear fire. The only difficulty with it was that it burned away much more quickly than was desirable. It was possible to regulate the products by altering the pressure and temperature inside the retort more than the majority of people were disposed to think; and it really was a question of what happened to be the most valuable product at a particular time. The best results were 14 gallons of tar, from 2 to 2½ gallons of light spirit suitable for motor-car work, and from 3 to 4 gallons of fuel oils suitable for Diesel engines. So that a very large proportion of useful substances could be obtained without sacrificing anything.

DOMESTIC ELECTRIC COOKING AND HEATING.

Results of One Year's Working.

Before the Engineering Section of the British Association on Friday last, Professor J. T. Morris, of the East London Technical College, gave some figures relating to electric cooking. During the last five years, he said, great strides have been made in the construction of the electric cooker; and it could now be confidently asserted that there are thoroughly reliable makes.

The other question is, What will the weekly consumption of energy be? If a householder can get an idea of the number of units which would be used, then, knowing the tariff for electric cooking in the district, he can form an approximate estimate as to the weekly cost of electric cooking in his case. It was his object, since but few figures of the kind are readily available, to give a definite answer to this question in one particular case, where the daily consumption had been recorded throughout a period of one full year.

Experience clearly brought out the following facts: (1) That those who have tried electric cooking know that joints of meat and steak are cooked better by electricity than by other means, and it is also true that a shorter period of training is required in order to be able to do so. (2) The heavy work in the kitchen is largely reduced, owing to the fact that there is far less coal to be handled, and there is no kitchen range to be cleaned and polished every morning. (3) The certainty that if the same time is given for the same operation exactly the same result will be produced. (4) The convenience and cleanliness and the avoidance of an unhealthy hot atmosphere in the kitchen.

He agreed that difficulty is experienced in the supply of hot water in large quantities—such as for washing up and for baths—where either the electric cooker or the ordinary gas-cooker is used; and although special arrangements are obtainable which will deal

with these large quantities, he did not believe that any of them can compete with coke or anthracite slow-combustion stoves—on the score of cost, at least. In large blocks of flats, a central boiler kept permanently fired could be used for the supply of hot water continuously.

In the present instance the arrangements used for cooking were a Jackson (Marylebone) electric cooker, having three hot plates, two for boiling and one of lower heat for simmering purposes, one grill, and a fair-sized oven; the approximate measurements being: Height, 38 in.; width, 30 in.; depth, 24 in. The Board of Trade units when the hot plates, &c., were in use individually for one hour, and the cost per hour at ½d. per unit are given in the following table:—

	Hot Plates.								
	No. 1.			No. 1.			No. 1.		
	Low.	Medium.	High.	Low.	Medium.	High.	Low.	Medium.	High.
Units used in one hour .	0·36	0·67	1·34	0·36	0·70	1·39	0·24	0·48	0·94
Cost per hour in pence at ½d. per unit	0·18	0·33	0·67	0·18	0·35	0·70	0·12	0·24	0·47

	Grill.	Oven.		
		One-third.	Two-thirds.	Two-thirds.
Units used in one hour .	1·34	1·06	2·11	3·17
Cost per hour in pence at ½d. per unit	0·67	0·53	1·05	1·58

The hot-water supply was obtained by a coke boiler, manufactured by the Carron Company (O-sho boiler), pattern Y.A. It stands 32 in. high, is 14 in. wide, and 14 in. deep.

A matter which required attention was the proper heating of the kitchen. Under ordinary circumstances, it was oppressively hot in the summer with a cool range; but when electric cooking was used then the kitchen was a much more healthy place, and the extra warmth required in winter could be obtained from the coke boiler by leaving its doors open.

Over a period of ten months, the quantity of coke used was 6 chaldrons, costing £4 11s., which, taking into account the wood needed to light the fire each morning, comes out at 4d. per day. Hence the running cost for electrical energy to the cooker and for the supply of hot water for all household purposes amounted to 8·87d. per day.

The figures were obtained in a flat having six rooms, a kitchen, and a bath room; and they represent the consumption for a household of five persons. In one room a coal fire was used for part of the period; and therefore the figures for heating are smaller than they would otherwise have been. There were no gas-pipes in the flat.

With reference to the lighting, the maximum weekly consumption was 6·5 units, which at ½d. per unit comes out at 3¼d. per week. The individual charges which make up the total expenditure throughout the year from July 27, 1912, to July 26, 1913, on cooking, heating, and lighting, are given below:—

	£	s.	d.
Annual "Telephone" charge	6	10	8
Hire of cooker, at 15s. per quarter	3	0	0
Cooking: 2934 units, at ½d.	6	2	3
Heating: 2068 ,, ,, ...	4	6	2
Lighting: 200 ,, ,, ...	0	8	4
	£20	7	5
Coke and wood	4	11	0
	£24	18	5

In comparing this method of heating and cooking with methods in which coal is used, it must be borne in mind, said Professor Morris, that a saving of from £25 to £30 has been made in the cost of domestic service; and, therefore, on the above tariff it is an indisputable fact that a considerable gain has been made on the score of economy, cleanliness, and independence.

Experience gained with this electric cooker had suggested the following as some of the directions in which improvements would be specially welcome: (1) At present a rather serious obstacle in the way of reheating dishes (a common every-day need in most households) was the relatively long time taken in bringing the oven to the working temperature; and consequently the disproportionately large expenditure of energy to effect a comparatively trifling result. (2) The time taken to boil a pint of water, more especially the first one in the morning, when the cooker is quite cold, might be shortened with considerable advantage. (3) Cooking utensils, however perfectly flat-bottomed they may be when first supplied, appear, with ordinary wear and tear, too soon to lose this quality, so necessary for economy both in time and in energy used.

These matters, however, were receiving attention at the hands of some designers of electric cookers. The latest form of electric cooker, of which about a dozen were in use at the present time, had the ovens arranged so that the direct radiation from the heater was not shielded in any way, with the result that the time taken for raising the oven to the working temperature had been reduced to about one-half of what it was in the older patterns. Further, in a week or two a red-hot plate would be put upon the market, which halved the time necessary for raising cold water up to the boiling point, avoiding the necessity for special utensils. It was robust, "for cold water can be poured on it with impunity."

In conclusion, Professor Morris said that many groundless misapprehensions exist in the minds of the general public as regards electric cooking. For instance, friends, on being invited to share an electrically cooked meal, may intimate an intention to bring with them a bag of biscuits—such is their confidence in the electric cooker! Or the charwoman, keeping at a safe distance from the cooker, will, while not doubting for a moment its ability to electrocute her on the spot, at the same time assure your maid that it "won't cook anything." Or, again, even if your maid herself has no fear of the cooker, her anxious relatives may do their best to persuade her that she is "taking her life in her hands" if she attempts to use it. Of course, all such objections quickly vanish before actual experience. Indeed, it might fairly be claimed, as to safety in use, that of the three most common methods of cooking food the electric cooker is, when properly installed, by far the safest. For instance, there was no chimney to get on fire, nor was there danger from stray cinders, or of explosions, unpleasant fumes, or of "firing-back." There was also the great advantage of perfect cleanliness in use. Saucepans, for instance, never became sooty outside. This fact alone saved a not inconsiderable amount of labour. Then, too, the walls and ceiling of the kitchen remained clean much longer. When to these two advantages of safety and cleanliness was added that of absolute reliability, it was obvious that electric cooking was an ideal method for use in an ordinary household.

Professor MORRIS added that since writing the paper he had obtained some information from Mr. R. A. Chattock, the Birmingham City Electrical Engineer, as to the charges for electric cooking there. Heating was charged at 1d. per unit and lighting at 3d., while, in addition, the apparatus was not hired-out, but sold on the hire-purchase system. The altered conditions would make a similar case in Birmingham come to £33 15s. 4d., compared with the £24 18s. 5d. given for the Marylebone case.

The CHAIRMAN (Professor Gisbert Kapp) pointed out that the paper contained no figures of the less shrinkage of meat by electric cooking, which was one of its great advantages.

Dr. J. A. FLEMING said he had carried on electric domestic cooking for three years; but one of its drawbacks was the irregular life of the heaters. There was also the difficulty that, as the stoves were at present constructed, the heaters were not detachable, with the result that if anything went wrong the whole oven had to be sent back to the makers for repair. He had endeavoured to persuade some of the makers to arrange the apparatus so that the hot plate was detachable, because at present it was a somewhat serious thing if anything went wrong while a meal was being cooked. As to the cost of electric cooking, he had to pay 1½d. per unit; and this put it out of court altogether for water heating. For this purpose, he was prepared to fall back upon his old friend (or enemy) gas. At ½d. per unit, electric cooking would compare favourably with coal or gas; and none who had ever cooked electrically would want to give it up. Even at 1d. per unit, it was comparable.

Mr. CHARLES WICKSTEED said the paper merely compared electricity with coal fire. Comparisons with gas were what were needed.

Professor MORRIS quite agreed with Dr. Fleming that the stoves should be so made that if anything went wrong it could be put right in the house at once. In Marylebone, however, the stoves were maintained by the Electricity Department; and the £3 included maintenance as well as hire. If anything went wrong, one had only to telephone to the Department, and it would be put right in two hours. On this particular stove also there was a spare hot plate; so that unless they both broke down at the same time (which was very unlikely), the stove could always be in use. He believed the hire charge of £3 was to be reduced considerably very shortly. The hiring system, he thought, was the best policy, as a stove might not be suitable if the owner was compelled for any reason to move into another district. As to comparisons with gas, the paper only pretended to give the results of a year's working with electric cooking, and he would leave it to someone who was familiar with a similar household served by gas to make comparisons.

Manchester and District Junior Gas Association.

The Hon. Secretary (Mr. J. Bridge, of the Stretford Gas-Works) forwards a copy of the programme for the forthcoming session, which opened last Saturday with a visit to the Bolton Gas-Works, and a paper by Mr. W. Fletcher, on the "Construction of Meters." An account of this meeting will be found elsewhere. The subsequent fixtures are as follows: Oct. 4, University Lecture by Mr. F. D. Marshall, on "Low-Temperature Carbonization in Vacuo." Oct. 18, visit to the National Gas Exhibition. Nov. 1, University Lecture by Mr. Jacques Abady, on "Illumination." Dec. 6, visit to Bury Gas-Works, and a paper by Mr. J. W. Thornley, entitled "Notes on Illumination by Low-Pressure Gas." Jan. 10, 1914, University Lecture by Mr. J. E. Christopher, on "Modern Coke-Oven Tendencies." Feb. 7, visit to the Manchester Electricity Works, and a paper by Mr. H. G. Haynes. March 7, University Lecture by Dr. J. W. Mellor, on "Refractory Material as Used in Gas-Works, and Testing of Same." In April, the general meeting will be held. May 9, a visit to the Great Harwood Gas-Works, and a paper by Mr. J. Edmondson, entitled "Mechanical Engineering Practice in Gas-Works." Arrangements have been made for members to take tea at the close of the University Lectures, after which an informal discussion will be held. The Hon. Secretary will notify all members of the subject for discussion.

VISIT TO THE BOLTON GAS-WORKS.

Manchester and District Junior Gas Association.

The Inaugural Meeting of session 1913-14 of the Manchester and District Junior Gas Association took place on Saturday at Bolton; between 60 and 70 members availing themselves of the invitation of the Chairman (Mr. Alderman William Webster) and Gas Committee of the Corporation, and the Engineer (Mr. W. J. Smith, B.Sc.), to visit the Lum Street and Gas Street works.

The Bolton Corporation have two stations for the manufacture of gas—viz., the Lum Street works, capacity 4 million cubic feet per day; and the Gas Street works, capacity 2 million cubic feet per day. The latter station was remodelled in 1910, and now produces more than one-half of the annual make of gas.

Lum Street Works.

Prior to the commencement of the present alterations, the retort-house was equipped with two benches, each containing 18 beds of eight ⊓-shaped retorts, 21 in. by 15 in. by 20 ft. long, and all worked by hand stoking. Of these, 27 were of the double generator type; the remaining nine having only single generator furnaces.

As the coal storage at these works was very limited, it was necessary to adopt a system which would liberate as much ground space as possible. To obtain this, five beds off the end of each bench have been demolished; and the new settings are being erected across the house, and at right angles to the existing ones. By this means full advantage has been taken of the small area occupied by vertical settings, and eventually one-half of the present retort-house will be utilized as a coal-store.

The new installation consists of nine beds of vertical retorts on the Woodall-Duckham system, four retorts per bed; each retort being 25 feet long, and tapering from 5 ft. 3 in. by 1 ft. 6 in. at the bottom to 3 ft. 10½ in. by 8 in. at the top, and capable of carbonizing 5 tons of coal per day. The coal-handling plant will consist of a large hopper situated at the end of the retort-bench and under the high-level railroad. Into this the coal will be tipped from waggons by hydraulic rams. By means of a regulated feed, the coal will then pass into the breaker-hopper, which is so placed that local coal brought in by carts can be tipped into it. The coal-breaker is fitted with an automatic feed and a bye-pass for small coal. A gravity bucket conveyor will deliver the coal into the overhead hoppers, which have a capacity of 48 hours' storage.

The high-level railroad, hydraulically operated, will encircle the retort-house, thus giving a through run for all coal traffic. As the coke is drawn from the retorts, it will be directed on to a tray conveyor by means of shoots, and delivered to an automatic skip loading apparatus. The skips will be lifted by a telpher, and the coke will either be deposited into stock or into the screening plant, which will separate the breeze (through ¾-inch holes), the 1½-inch, and the 2½-inch nuts from the large coke. From the screens, the coke drops into hoppers, from which the carts and waggons will be loaded. A new building situated near the coal-breaker pit will contain the power plant, which will be in duplicate, and driven by 100 H.P. gas-engines.

Two retort-house governors are fitted on the foul main near to the settings; and from here the gas is drawn through the atmospheric and water condensers, erected in 1911, by a Waller four-blade exhauster. From this the gas passes through the washer and scrubbers on to the purifiers. No. 1 purifier-house contains eight 20-feet square purifiers, filled with oxide of iron. Each pair of boxes in No. 1 house are coupled together and act as a single box, making the purifying area equal to four boxes each 20 feet by 40 feet. On entering this house, the gas is divided into two streams, each stream passing through two of these boxes, then both uniting again; the whole passing through the four boxes in the No. 2 house. This arrangement had to be adopted on account of back-pressure, and has been found to be effective; the total sulphur compounds in the gas for the past year only averaging 13·39 grains per 100 cubic feet.

From here the gas passes on through the meters into the holder. A 2¼ million cubic feet holder, with four lifts, spiral guided, is in course of erection, and will replace one of half its capacity. A steel "liner" 34 feet deep by 153 feet diameter has been inserted within the old masonry tank; the intervening space being filled up with concrete.

The two works are connected by a 16-inch main; and during the alterations all the gas made at the Lum Street works is sent to the holder station at Bullfield.

Gas Street Works.

At these works all the materials received or dispatched by rail are handled by a locomotive. The coal-waggons are tipped by hydraulic rams; the coal passing through a breaker into the elevator buckets, which deliver on to a push-plate conveyor. By means of this conveyor, the coal is deposited into the storage hoppers, which extend the full length of the retort-bench, and have a capacity of 24 hours' supply.

The retort-house contains 18 beds of eight ⊓-shaped retorts, of dimensions as at Lum Street. The furnaces are all of the regenerative type, and were installed by Messrs. Drakes Limited, of Halifax. The retorts are mechanically operated by a West simultaneous charging and discharging machine, which places 7½ cwt. of coal in a through retort; the duration of charge being six hours.

The coke is discharged from the retorts into skips, partly quenched by the attendants, removed by a telpher, dipped into a quenching tank, and finally deposited into a hopper (for screening purposes) or into the yard. The power plant situated in a corner of the retort-house is in duplicate. It consists of two 30-H.P. gas-engines, direct coupled to two Siemens compound wound generators; the gas-engines being provided with magneto ignitions and self-starters.

The purifiers are in the form of a large box, 60 feet by 90 feet, which is separated by means of division-plates into six boxes each 30 feet square by 6 feet deep. They are of the luteless type; the first two being filled with lime, and the remaining four with oxide. The valves are of the Weck type, and are combined with, and form part of, the boxes, thus dispensing with a large number of connections. The purifying materials are handled in skips by means of a Barker friction hoist, which is driven by a 16-H.P. gas-engine.

All the ammoniacal liquor produced at this station is pumped into an overhead tank, from which it flows by gravity to the Lum Street works, where a sulphate plant of 6 tons 15 cwt. per day capacity is situated.

A full description of the Gas Street works will be found in the "Journal" for May 23, 1911 (pp. 516-523).

The Chairman's Welcome.

The party were welcomed at the Lum Street works by Alderman Webster and Mr. Smith; and under the guidance of these gentlemen, assisted by Messrs. R. Neill, E. Hardicker, and T. Vanston (assistants in the Gas Department), and Mr. J. Wilkins (representing the Contractors, Messrs. Gibbons Limited, of Dudley), an inspection was made of a setting of nine beds of Woodall-Duckham vertical retorts now in course of erection, which will have a capacity of 2 million cubic feet per diem.

Alderman Webster said that, on behalf of the Gas Committee, he extended to the visitors a hearty welcome, and hoped they would have a pleasant and profitable meeting. In his opinion, the educational importance of such visits could not be over-estimated. They should be encouraged in every possible way. After pointing out a new gasholder which has recently been erected, Alderman Webster went on to say that the Gas Committee were spending about £60,000 on the Lum Street works, and a proportionately large amount at Gas Street.

Tea and Speeches.

About an hour-and-a-quarter was profitably spent in the works at Lum Street, and an hour at Gas Street, where the party inspected the West stoking machinery. After this, a move was made to the Gas Offices, where the members were entertained at tea by the Gas Committee. Subsequently,

The President (Mr. W. L. Heald, of Preston) said he was sure the members would agree that they had had a very pleasant visit, and on their behalf he desired to express to Alderman Webster and Mr. Smith their grateful thanks for all they had done for them.

Mr. J. M'Nicholl (Warrington), the Junior Vice-President, proposed that a hearty vote of thanks be accorded to Alderman Webster and the members of the Gas Committee for their kindness that day and for the hospitality extended to them. With the names of the Chairman and Mr. Smith, he desired to couple those of the staff, who had been exceedingly attentive to them that afternoon, and assisted them in every possible way. The vertical retort installation they had inspected was in a very interesting stage; and, as a matter of fact, a more opportune time for seeing it could not have been chosen. They would all go away a good deal wiser than when they came.

Mr. Franklin Thorp (Manchester) seconded the motion, which was carried by acclamation.

Alderman Webster thanked the members, and assured them that it gave him the greatest possible pleasure to join them that afternoon. At one time, he was afraid that, being so well acquainted with gas-works in other towns, Bolton would not be able to show them anything new; but when he recollected that they were in the midst of large alterations at Lum Street, it occurred to him that possibly the younger members of the Association would be interested to see the works in course of erection. They were expecting great things from the Woodall-Duckham verticals when completed, and were most anxious to get the plant into working order as soon as possible. He hoped that they had enjoyed their visit, and trusted that it had been an instructive one. He would convey to his Committee the thanks they had expressed so unanimously.

Mr. Smith also thanked the members for their appreciative remarks, and said his Committee had generously supported him in making the visit a success. He assured them that his Chairman and Committee considered it a compliment that the members of the Association should have selected Bolton for the opening of the new session.

The President observed that the author of the paper which was to be read a little later on was Mr. W. Fletcher, of Liverpool, one of the younger members. He (Mr. Heald) had this session asked members who had not done so before to read papers. This, as they all knew, was following out the "forward policy" foreshadowed last session; his idea being that the Association was intended to be an educational one, and that young men should be drawn to the front. There was no burking the question. Some day they would have to place their ideas lucidly before the public, and what better training ground could there be than before a body of appreciative fellow-members? In a sense the Association could claim to be the public, inasmuch as their proceedings were reported to the gas industry generally. Every member ought to take the opportunity of exerting

himself, not so much for the benefit of everybody else, but for his own benefit. Then, again, if a member did not get the opportunity of reading a paper, he could at times propose or second a formal vote of thanks. Some of them might not care to do so; but they should persevere. Even a vote of thanks was a stepping-stone towards public speaking; and the art of public speaking was the stepping-stone to other successes. Proceeding, he reminded the embryo gas engineer that some day he would have to speak before a committee or board of directors, and expound his views on policy, besides outlining schemes before the Board of Trade, or, possibly, a Select Committee of the House of Commons. It therefore behoved members to speak in the open as often as possible. He mentioned these matters because he had thought about them for some time, and felt they should be expressed. He went on to refer to the prizes offered by Mr. Samuel Tagg, the Engineer and Manager of the Preston Gas Company, for the two best papers of comment or criticism relative to any piece of plant, apparatus, or method of working noticed on the visits of members to Bolton, Bury, London (Gas Exhibition), and the Manchester Electricity Station; the donor's desire being to encourage the habit of thoughtful observation. No plant, apparatus, or method of working was too large or too small to compete for the prizes offered; the only limit being the length of the paper, which should be of not less than 150 words, or not more than about 300. He used the word "about" advisedly, because 350 words would not disqualify. The object in putting a limit on the number of words was to encourage concise reporting.

THE PAPER.

Mr. FLETCHER then read his paper on the "Construction of Meters," which, with the remarks upon it, will be found below.

THE CONSTRUCTION OF METERS.

By W. FLETCHER, of Liverpool.

[A Paper read before the Manchester Junior Gas Association, Sept. 13.]

Gas was first sold at so much per burner, according to its consumption per hour. As, however, this was not a very satisfactory method, something had to be devised in the way of an apparatus for registering the volume of gas used; and in 1815, Mr. Clegg constructed the first meter, which was improved and patented in the following year. It consisted of two small holders, which filled and emptied alternately. Something resembling our present-day meter was next brought forward by Mr. Malam in the year 1819; and since that time meters have made great strides, until to-day we have a large variety of efficient meters, both wet and dry.

Wet meters are so-called because they depend upon the presence of water (which has to be maintained at a certain level) for their method of registering the gas. The measuring arrangement is a drum partly immersed and revolving in water. The measuring arrangement in a dry gas-meter is a pair or more of bellows, which are alternately filled with gas and emptied; the motive power being the pressure of the gas. The presence of water in any form is injurious to the diaphragms and mechanism of a dry meter. Another type of dry gas-meter is the rotary or discount meter, which has a series of blades or vanes, against which the gas impinges, causing them to revolve.

WET METERS.

As previously stated, the measurement arrangement in the wet meter depends upon a drum partly immersed and revolving in water. The drum has to be perfectly balanced, in order to minimize the friction. To ensure this, all parts of the drum, and meter also, are either carefully templated or stamped out of the sheet by accurately made dies. The body of the drum, having been cut exactly to size, is now templated, the lines showing the positions for the vanes and cover-pieces. Having been carefully scribed, the body is next rolled, fixed in a clamp, and soldered so as to form a true circle. The vanes, which are set obliquely to both the vertical and horizontal planes, are now put in. These are followed by the cover-pieces, the drum-shaft, and the hood. The drum is next tested for balance. Any defect in balance may now be rectified by putting a blob of solder on the drum body in such a position as to restore balance.

The motive power in a wet meter is the pressure of the gas acting against the surface of the water and the vanes of the drum; and as one offers less resistance than the other, the weaker one, which is the vane, gives way, causing the drum to revolve. Therefore we have the gas entering from the front box of the meter, under the hood of the drum, exerting a force upon the drum, causing it to revolve, and escaping through the back of the drum away to the outlet of the meter. As one compartment is being emptied of gas and immersed in the water again, another is filling; and so the action goes on, with a continuous and easy movement.

Let us now consider the front box of a simple effective meter used by the Liverpool Gas Company. The gas enters through the inlet of the meter, passes through the valve, down a gas-way in the left-hand corner of the top of the front box, into the bottom front box, along another gas-way, and up through the syphon and under the hood of the drum. The valve-box under consideration is divided off into two parts—a higher and a lower. The valve-seating is fitted on the division plate between the two, while the valve itself is free to move in a vertical direction in the top box. Connecting the valve to the float is the valve wire, which runs through a tube so designed that the inlet gas cannot pass through the front box. It can readily be seen that, when the water-level in the meter drops, the float will also drop, so closing the valve, and shutting off the supply of gas until the meter is again charged. This float, then, is the piece of apparatus which controls the low-water line, and so safeguards the gas company.

The high-water line is controlled by the overflow, which, when too much water is put into the meter, allows the surplus water to pass into the bottom front box, or overflow-box—thus safeguarding the consumer. The float and the overflow are the two parts which confine the limit of error of the meter to 5 per cent., which is the figure allowed by the Board of Trade under the Sale of Gas Act, 1859. A meter is correct, within the meaning of the Act, when it is within a certain limit of error—viz., 2 per cent. fast against the consumer; and 3 per cent. slow in favour of the consumer. It is obvious, then, that the tester must so set the valve and overflow that the former comes into operation when the meter registers 3 per cent. slow, and the latter when it registers 2 per cent. fast, to the consumer.

Coming back to the overflow, there are several varieties, perhaps one of the oldest of which is the cut overflow. This consists of a piece of piping, out of the top of which a piece is cut. A more modern type, and, perhaps, one of the best overflows, is one which consists of a screwed body, which is soldered down on the division plate of the front box. On this pipe is screwed a sleeve with a bell-shaped top, which can be regulated by screwing up or down as required. The disadvantage of the former is that a special glass front must be temporarily fitted on to the front box, whereas in the latter type, the adjustment can be effected through a hole specially made in the top of the front box.

The above are the main features of a wet meter; but, in addition, we have the following parts, each of which has its own special function to perform: (1) The well spout, or charging pipe, running from the top of the front box down below the water-level, so that it is possible to charge the meter with the gas on. Across this pipe is often soldered a piece of wire, which prevents the insertion of a rubber tube to syphon the water out. (2) A vent-pipe, which runs from the bottom box to above the water-level, to allow for air or gas displacement when the water overflows into the bottom box. (3) An overflow cap in the front of the bottom box, and so protected that it is impossible to syphon all the water out of the bottom box, and so obtain unregistered gas. There is also a division plate in this bottom box, so placed that if all the water were drawn from the front half of the box, the drain-pipe would still be sealed. (4) The index driven by an upright shaft, having a worm at the top which gears into the index, and a worm-wheel at the bottom which engages with the worm on the drum-shaft. Surrounding this shaft is the dip-pipe, the bottom end of which is sealed, while the top end tapers off and runs through the top of the front box. It is the length of this pipe which governs the pressure that the meter will stand. In some cases this dip-pipe is fitted with a stuffing-box, in which case it is not affected by pressure.

Table Showing Capacity of Drum and Meter.

Size of Meter. Lights.	Diameter of Connections in Inches.	Measuring Capacity in Cubic Feet, per Revolution.	per Hour.
3	⅝	0·125	18
5	¾	0·25	30
10	1	0 5	60
20	1¼	1·0	120
50	1½	2·5	300

COMPENSATING METERS.

As the volume of water between the high and low water line is in some cases very quickly evaporated, attempts have been made to introduce compensating arrangements; and perhaps the most successful of these are: The spoon compensating meter; the Warner and Cowan compensating drum; and the cheese float meter (Sanders and Donovan's).

The spoon compensating method consists of one or two "scoops" or "spoons," which dip at regular intervals into a small reservoir contained in the meter case, lifting from it a small quantity of water which flows into the measuring chamber. Thus water in the drum is maintained at a constant level; any excess finding its way back again into the reservoir. The chief fault in this meter was that it absorbed too much pressure in the working of the spoon mechanism, whereas a good meter (say, a 3 or 5 light) should not absorb more than 1-10th of an inch pressure.

The Warner and Cowan compensating drum consists of a small drum set in the larger one, having its vanes set in the opposite direction. It can readily be seen that, though the larger drum will pass gas in the usual direction, the smaller drum will return some of it—thus causing a sort of churning action. The higher the water-line in the meter, the less gas will be passed per revolution of the larger drum, and the less gas returned by the smaller drum; whereas when the water-line drops, then the capacity of the larger drum increases, but so also does the capacity of the smaller drum. The proportion between the gas passed by the larger drum, and the gas returned by the smaller drum, therefore, remains the same.

Another, and perhaps one of the most popular of compensating meters is the "cheese" float. This consists of a large float, similar in shape to a half-cheese, pivoted in the front box of the meter. When the meter is charged, the float revolves and rises; but as evaporation takes place, the float commences to rotate

backwards. As it descends, its effective bulk increases, displacing a corresponding amount of water, and thus maintaining an unvarying water-line. As the water continues to decrease, the float still further revolves, until the valve, which is fitted on the float, comes up against the valve-seating—thus shutting-off the supply of gas until the meter is charged, when the float again rises.

Average Quantity of Water in Cubic Inches which can be Withdrawn from Meters, between the High and Low Water Lines.

Size: Lights.	Ordinary Meter.	Cheese Float.	Warner and Cowan's.
3	17	60	39
5	30	105	60
10	50	142	78
20	110	312	113

Dry Meters.

As previously stated, the dry meter does not require water, the presence of which in any form is injurious to the mechanism. To guard against this it is advisable, when fixing, to supply a syphon at both inlet and outlet. The dry meter consists of a rectangular chamber divided into three compartments. In the upper part a horizontal valve-plate divides off the valve-box and index, &c., from the measuring chambers. The lower portion is equally divided by a vertical partition. It is on each side of this partition that the diaphragms are fixed to a metallic rim; the other side of the diaphragm being covered over by a metal disc. These diaphragms are made of the best Persian sheep skin, which should be absolutely free from tick or bristle holes, and other flaws, and should be carefully tested in a dark room by holding the skin up to a strong light, when any holes will at once be seen. There is a special stitch—known as the "glove stitch" which only goes half-way through the leather—used in the making of the diaphragms. The diaphragms are well oiled before being fixed in the meter. To the disc are fixed lugs, through which go guide-wires, to ensure the diaphragm moving in and out evenly and in a true vertical plane.

Thus we have four distinct chambers—namely, the interiors of the diaphragms and the exteriors of same—*i.e.*, the spaces the flexible chambers or diaphragms are capable of moving through, all of which are in communication with their respective ports of the slide-valves in the upper compartment. The gas on entering one of the diaphragm chambers expels an equal volume of gas from the outer chamber to the meter outlet; and when the disc has passed through a certain definite distance, the position of the valve changes, reversing the action, so that the gas now enters the outer chamber, causing an equal volume to be expelled from the diaphragm chambers. Thus the movement is repeated alternately in both of the lower chambers, and is conveyed through the flag-wires and tangent to the tangent-pin, which is fixed to the crank in the upper chamber or attic of the meter. By means of a worm fixed on the crank-shaft, working through suitable gearing, the volume of gas passed through the meter is registered on the index. The valves, which are fixed one over each measuring chamber, are similar to the slide-valve of an ordinary steam-engine. Each valve has three ports, two of which are in communication respectively with the inside and outside of the chamber, and the third (the middle one) with the outlet of the meter. The gas inlet is, in each case, on the top of the valves.

Gas entering one of the diaphragm chambers (say, the right-hand side one) causes the disc to move through a certain distance, and in doing so it will expel the same volume of gas from the right outer chamber. When the diaphragm is distended to the requisite extent, the position of the valve cover changes. The gas then enters the outer chamber, driving the gas from inside the diaphragm chamber away to the outlet of the meter. When the right-hand diaphragm is about fully contracted, the left-hand disc commences to move outwards; gas being admitted to the inside of the diaphragm chamber, and driven from the outside compartment away to the outlet of the meter. Again, when the left-hand diaphragm is about fully extended, gas is again admitted to the inside of the right-hand diaphragm; and so this goes on in an easy continuous movement.

The next thing of importance to be dealt with is the tangent. It depends on the position of the pin on this tangent whether the meter is to register fast or slow. It can readily be seen that the further the centre of the tangent pin is from the crank-shaft the slower the meter will register, and the nearer they are together the faster it will register. Thus the tangent pin has to be set in such a position on the tangent arm that the meter registers "correct" within the meaning of the Act. The reason for this is that, when the tangent pin is in the slow position, the circumference of the circle it has to travel is longer than the circumference in the correct position. Consequently, it takes longer for the crank to make one revolution; thus allowing the diaphragm to become too fully distended, and so pass more gas than is registered. The opposite takes place when the tangent pin travels along a small circumference—*i.e.*, when the meter is registering fast.

All unions on meters should be made to a standard size, and tested with special gauges. If this precaution is neglected, trouble is apt to be encountered when the meters are being connected up, as some makers' unions may be entirely different from others.

Prepayment Meters.

About the year 1888, Mr. Brownhill, of Walsall, just realized that some type of mechanism was required on a meter which would enable the gas to be obtained and paid for as required. He, therefore, invented and supplied the first automatic attachment, which would supply a certain volume of gas for every penny put into the attachment. Although Mr. Brownhill's attachment was not perfect, and left much to be desired, yet he will always be remembered with esteem as the pioneer of automatic attachments. [It is interesting to note that the first gas undertaking in the country to introduce the prepayment meter was the Liverpool Gas Company.] Since Mr. Brownhill's day, great improvements have been made, improved valves have been obtained, and simpler attachments have been introduced, which have now resolved themselves into two classes—viz., "change wheel" and "radial" attachments, in which we can, if desired, give more or less gas for the penny.

Probably one of the simplest and most efficient of the former type is Parr's attachment. This attachment consists of a coin-carrier, made in two parts, so that the handle half comes into operation only when the penny is inserted. The other half connects on to a long worm spindle, on which is (if we might so call it) a nut. This nut is round, having two flanged edges—*i.e.*, there is a groove turned in the centre of it, in which the arm for the valve-lever works. The flanged edges have teeth on them working into a long pinion which connects through toothed wheels—one of them being a change-wheel, pivoted on a quadrant, on to the index shaft. It can be seen that when a penny is put into the attachment and the handle turned half-round (when the penny drops into the coin-box), the worm spindle turns round, and in so doing moves the nut along, which opens the valve and allows gas to pass. The opposite action takes place when the gas is being consumed, and the nut is slowly driven the other way along the worm spindle by the long pinion—thus slowly closing the valve and shutting off the supply of gas. The gearing is so designed that a change-wheel with 25 teeth on it will give 25 cubic feet of gas for one penny; a 30-teeth wheel will give 30 cubic feet, &c. All change-wheels should have the number of teeth carefully stamped on them.

As change-wheels usually necessitated the meter being brought into the shops when the price of gas was changed, another form of attachment—namely, the radial attachment—has been designed. This enables the volume of gas given for the penny to be changed with the minimum amount of trouble, while the meter is still fixed. One of the best known of this type is Cannon's. This consists of a circular graduated dial containing a coin-slot. Working directly behind this and pivoted at the centre of the disc is a coin-carrier worked by a handle at the front. When the penny is put in the slot, it falls into the carrier and engages with a special toothed wheel at the back of the carrier, which can now be turned by turning the handle. This operation turns a spindle, on which is a flanged wheel, which takes the valve-lever as in the case of the change-wheel attachment. At the far end of the spindle is a worm, working through a round nut, the edge of which forms a toothed wheel, which engages with a worm connected to the index shaft. The inlet slot for the coin in this attachment is movable, but the outlet of the coin into the cash-box is stationary. The opening and closing of the valve is operated in exactly the same manner as in the change-wheel attachment.

DISCUSSION.

Cordial applause greeted Mr. Fletcher at the conclusion of his paper, the value of which was greatly enhanced by about forty slides—coloured and otherwise—being thrown on to a screen.

The President (Mr. W. L. Heald, of Preston) said he was sure the members would agree that they had listened to a capital paper, and one which had been greatly improved by the slides they had seen.

Mr. J. W. Thornley (Salford) said he noticed the author remarked that it was advisable for dry meters to have a syphon on both inlet and outlet. One objection which he (the speaker) had to a common form of syphon on the inlet was on the ground that it was thus possible to procure a supply of gas from this source without it having passed through the meter. With regard to the table showing the quantity of gas passed in cubic feet per hour by various sizes of meters, it would be interesting to know what these meters would pass at higher pressures—say, up to 4 inches—and what conditions were then existing (*e.g.*, how much the meter would be working slow). Dealing with prepayment meters, he mentioned that a matter for the consideration of makers was the large number of complaints due to a penny getting fast in the attachment. If this matter was adjusted, much time might be saved for undertakings and trouble for the consumers. A case which he came across some little time ago might interest the members. It related to a 200-light dry meter used to supply two 15 B.H.P. gas-engines, with a length of 3-inch service of about 500 yards; the meter being in a strong hut in a large yard. After being fixed some time, about two buckets of water were found in the meter, though the syphon-pot on the surface close to it was perfectly dry. He did not offer any personal opinion on the matter; but it would be interesting to know if any of the members had had a similar experience.

Mr. J. W. Nichol (Redcliffe) asked, in regard to the overflow with the bell-shaped top, whether this could be altered from the top. If so, was it not in danger of being tampered with by the public, so as to get a certain percentage of free gas, or was it sealed?

Mr. Fletcher replied that the overflow could not be tampered

with, as it was sealed with a tin disc, and the index box placed over the top.

Mr. NICHOL, dealing with the dip-pipe, said he thought all modern meters were fitted with stuffing-boxes to withstand the high-pressures at which they were used. Commenting upon the figures quoted by the author in regard to the average quantity of water in cubic inches withdrawn from meters between the high and low water level, Mr. Nichol quoted figures from a well-known text-book showing higher percentages varying from 43 (twenty-light) to 106 (three-light), compared with Mr. Fletcher's figures. Would it not, he asked, have been better to leave out the three-light meters, which were too small for up-to-date requirements, and were a source of unaccounted-for gas?

Mr. FLETCHER replied that the figures he quoted referred to the meters used at Liverpool. As regarded three-light meters, they had a lot of them in use, and could hardly do without them. He believed the Liverpool Gas Company supplied more three-light meters than any other size.

Messrs. W. HALL (Manchester), W. BUCKLEY (Manchester), J. M'NICHOLL (Warrington), and the PRESIDENT also contributed to the discussion, which embraced a number of interesting points, one of which had reference to the comparative merits of the wet and dry meters manufactured by the Liverpool Gas Company, and their average life.

Mr. FLETCHER replied that meters in Liverpool were guaranteed for five years; but this was a riduculous figure, for the average meter lasted anything from ten to thirty years. One could not really tell the life of a meter; it all depended where it was fixed. For instance, a meter fixed in a butcher's shop where they were continually washing down, and in a damp and moist atmosphere, would not last half as long as in an ordinary house. Personally, he thought the wet meter was the more satisfactory of the two; it did not get out of order so quickly. The chief failing of the dry meter lay in the valves and diaphragm.

Mr. NICHOL observed that he put his question with a view to ascertaining whether the Liverpool Company made periodical changes of meters in use (say) every five or ten years.

Mr. FLETCHER remarked that there was no hard-and-fast line. He had seen records of their meters which had been in use for at least twenty-five years.

Mr. FRANKLIN THORP said that Mr. Fletcher spoke of gas being originally sold at so much a burner, according to its consumption per hour. It was strange how things came round in cycles, because to day big cities like Manchester and Birmingham were adopting this system for certain kinds of street lighting. Lamps to-day were being lighted at so much per annum, which meant, of course, that they were selling gas at so much a burner. The dry meter, he continued, had come into favour very rapidly since the introduction of the penny-in-the-slot meter; and though Mr. Browhill, of Walsall, had the credit of being the first to realize that some type of mechanism was required which would enable the gas to be obtained and paid for as required, his (Mr. Thorp's) father was the second man. He claimed that his father made the first workable penny-in-the-slot meter. He (the speaker) thought that the first meters were fixed in Liverpool, for the Corporation; but such was the prejudice against them that the public would not take them under any conditions. People who had the "courage" to adopt them had to be guaranteed against all kinds of accident; and fire policies had to be taken out covering the risk of spontaneous combustion. When a new idea was being launched, all sorts of difficulties were met with. Why this should be the fact, was remarkable. Mr. Fletcher had mentioned the question of the capacities of meters. Might he say that there was a revolution coming in meters at the present moment? He recently carried out tests whereby a three-light meter passing 18 cubic feet at 5-10ths pressure was enabled to pass 100 feet at 3-10ths. This was the kind of work which meter manufacturers had set themselves to do. The advantages were obvious; for with the greater demand for gas-boilers and other apparatus in conjunction with cookers and fires, there was a corresponding demand for increased meter capacity. With respect to the wet meter, something of the same kind had been accomplished, but not quite to the same extent. The subject of meters was a most interesting one, and some day they might very profitably have a discussion of the relative types, for the gas-meter was, after all, the means whereby undertakings secured their revenue.

The PRESIDENT said that one type of meter which Mr. Fletcher had not referred to was the underground meter, of which they had about 5000 in Preston—an invention of Mr. Green's which enabled the inspector to take the reading when access could not be gained to the house, when consumers worked in the mills all day. There was, however, the liability to flooding, which caused the front plate to become "sprung," and consequently the float went down. As to the longevity of dry meters, he had seen them brought out after thirty-five years' service. He assured Mr. Nichol that there was still a use for three-light meters—*i.e.*, on lamps. In Preston they had a meter on every lamp.

Mr. FLETCHER, dealing with Mr. Thorp's remark about the sale of gas at so much a burner, said in Liverpool they sold gas in this way to the Dock Board.

Mr. NICHOL, in proposing a vote of thanks to Mr. Fletcher for his paper, said he was sure they would all agree that it was a valuable addition to their "Transactions." Prior to coming to the meeting, he read up a good deal about meters in Newbigging's "Handbook;" and the advice he there found was, "Keep up the efficiency of your meters." This was certainly good, sound advice. He also desired to congratulate the Liverpool Gas Company upon being the first to introduce slot meters.

Mr. J. MURGATROYD (Bury) seconded the motion, which was carried with applause.

Mr. FLETCHER, in returning thanks, paid a tribute to several members of the staff of the Liverpool United Gas Company, who had rendered him every possible assistance in the preparation of his paper.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Practical Men for Practical Positions.

SIR,—In the article which appeared in your issue of the 26th ult., under the above heading, the writer states that "it is absolutely necessary for engineers associated with the gas industry being essentially practical men in their profession."

Surely the individual who is only practical has neither the right nor the qualifications to assume the title of engineer or consider himself a professional man. Those engineers who are always denouncing theory, no doubt adopt this attitude, in order to mask the absence of this very essential part of an engineer's training. Such people assume that a knowledge of theory, or the scientific principles upon which engineering is based, necessitates absolute ignorance of all practical work or training. This is a glaring error, which only a very "eminently practical man" is likely to make.

In gas engineering, as in all other branches of the engineering profession, the man of real value must be acquainted both with theory and practice—the two branches must be combined.

R. J. MILBOURNE.

Muxton Lodge, near Newport, Shropshire,
Sept. 10, 1913.

The Design of a Gasholder.

SIR,—In printing the second instalment of my article under the above title in your issue of Sept. 2 (pp. 611 to 614), it would have been better had you reprinted the opening remarks regarding my indebtedness to Mr. F. S. Cripps; for it was to the first portion of the instalment in question that the acknowledgment refers.

The method of treatment and formulæ employed on pp. 611 and 612 are all taken from Mr. Cripps's work, with the exception of the actual figures and the application of the numerical results in designing the various sections used for the guide-framing. The formula for the top curb stresses on p. 612, col. 2, is also taken from the same source.

By these remarks, and my reference in the article to Mr. Cripps's work, it may be inferred that his book ["The Guide-Framing of Gasholders"] is of value only to those studying the theoretical aspect of the subject. On the contrary, the book is an excellent guide to general gasholder design. It is full of matter which emphasizes the practical points of the subject, and is of great value to all gas men who have had a training in the general principles of engineering design.

ENGINEER.

London, Sept. 11, 1913.

Enfield Gas Company.

At the general meeting of the Enfield Gas Company on the 4th inst. (which was presided over by Col. Sir A. P. Somerset, K.C.B.), the proprietors adopted the report and accounts for the half year to June 30, some particulars from which were given on p. 572 of the "JOURNAL" for the 26th ult. The customary dividend was declared on the consolidated ordinary stock at the rate of 5½ per cent. per annum (with an additional distribution at the rate of 1½ per cent. per annum), and on the consolidated preference stock at the rate of 5 per cent. per annum. The Chairman and Directors, the General Manager and Secretary (Mr. C. W. Offord), and the staff were heartily thanked for their services. A few interesting features of the accounts and working results may be noted. The capital employed per million cubic feet of gas sold amounted to £741, as compared with £777 at the same date in the previous year. The quantity of gas sold in the six months was 130,488,600 cubic feet, which was an increase of 7,866,000 feet, or 6·41 per cent. The coal used showed an increase of 1025 tons; and the additional cost per ton carbonized over the whole quantity used, as compared with the same half of 1912, was nearly 1s. 6d. The gas made per ton amounted to 11,547 cubic feet; the standard being 15 candles tested with the No. 1 "London" argand. Lime is used in purification, as well as oxide of iron. The increased cost of coal was £1825; while residuals brought in a return which was larger by £1115. The net gas-rental was £957 more, and the receipts on account of meters, cookers, fires, and fittings £254 more. The number of consumers increased by 435, to 10,958; and the users of cookers by 497, to 7929.

Lewes Gas Company.—A satisfactory condition of affairs was revealed by the report and accounts adopted at the recent meeting of the Lewes Gas Company. The revenue account showed a profit for the past half year of £1747; and dividends were recommended at the rate of 5 per cent. upon the original capital stock and 3½ per cent. upon the additional capital stock—absorbing £1397. In spite of a considerable portion of the public lighting having been placed in the hands of the Electricity Company, the total sum received from gas sales exhibited an increase. The Chairman (Mr. M. S. Blaker) acknowledged the services of Mr. Edward Jones, the Manager, and apologized for the absence of Alderman John Miles, a member of the Board, who, he said, had sustained a great bereavement in the death of his wife.

REGISTER OF PATENTS.

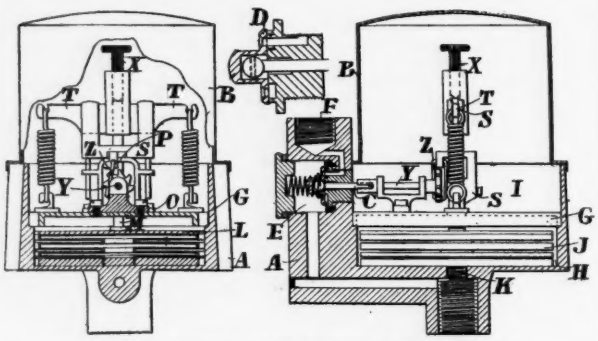
Controlling the Gas Supply to Burners.

ANDERSON, J., of Edinburgh.

No. 18,674; Aug. 14, 1912.

This invention relates to "gas controllers"—apparatus for lighting and extinguishing gas when desired—more particularly as described in patent No. 5918 of 1909.

The present invention "consists in a high-pressure gas controller with aneroid chambers or the like disposed in a casing, which limits the change of form of these chambers under change of pressure, whereby an arrangement is obtained which can be subjected to high pressure without injury, and yet be sufficiently flexible to operate under a small change of pressure."



Anderson's (Alder and Mackay) Gas Lamp Controller.

The illustration shows a construction of the controller in sections at right angles to each other.

The controller may be considered as constituted of four parts: (1) The casing; (2) the aneroid chambers; (3) the operating and adjusting mechanism; (4) the valve.

The casing is formed of a base A and a cover B; the base being formed with a central gas inlet leading by an external pipe to a valve chamber E formed in a vertical casting forming part of the base. The cover is of sufficient height to take the necessary mechanism and (as the interior of the controller is only under atmospheric pressure) need not be hermetically sealed. In the base is a metal disc G which divides the lower part of the casing into two chambers H I. In the lower chamber are (preferably) three flexible metallic cells J like those employed in aneroid barometers—being closed except for a connection K from the bottom one leading to the gas inlet. Above the top cell and between it and the plate G is a loose metal plate L, about equal to the diameter of the aneroid chambers. It has a small cup fixed to its top side, to receive a steel rod M. When pressure is applied to the aneroid chambers, the plate K and rod M are raised until the plate L contacts with the fixed plate G. Any further distension of the cells vertically is thus prevented.

The operating and adjusting mechanism comprises, as to the first part, a vertical arch piece forming two bearings O P for the rod M, and provided with two guiding lugs for pins attached to a bracket S having two parts, one above the arch and one below, maintained in fixed relation to the steel rod by a set screw. [An arrangement of this character was indicated in Patent No. 6754 of 1909.] The upper part of the bracket S is formed as a guide to take a bridge piece T, the arms of which carry springs connected with hooks fixed to the plate G. The bridge piece is also provided with a central boss tapped at the top for the reception of a small screwed spindle X which bears on the top of the rod M, so that the springs can be put to the desired tension.

Vertical motion of the rod M and its attached parts is communicated to a valve shaft by a swinging link Z depending from the bracket S. This operates a ratchet C mounted at one end of the shaft Y carried in a double bearing piece screwed to the plate G, which shaft at the other end is provided with a slot for the reception of a pin on the shaft C of the rotary valve.

In operation, when it is desired to light the gas lamps, gas at a suitable pressure distends the operating cells J, giving them a limited vertical movement, and thereby moving the steel rod M upwards against the action of the controlling springs. This raises the swinging link Z and so rotates the shaft Y and the valve plate D by an amount to bring a port in the rotary part of the valve opposite a port in the stationary part, whereby gas passes from the inlet through the passages in the casting to the valve chamber E, and thence to the gas exit F. A similar operation is performed whether the lamps have to be lighted or extinguished.

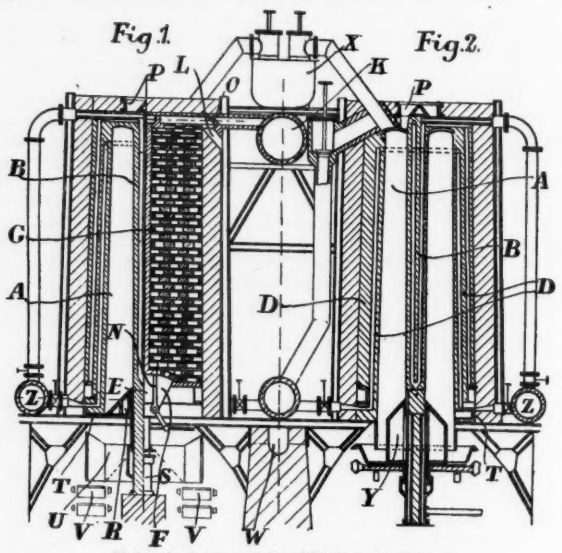
Making Coke and Gas.

NELSEN, H., of Essen-Rüttenscheid, Germany.

No. 14,376; June 19, 1912. Convention date, June 26, 1911.

This invention has for its object "a vertical annular coke-oven, intended to manufacture good coke and good gas with few attendants, from coals rich in gas, with small consumption of fuel."

Heretofore in vertical annular coke and gas retorts of this kind, the patentee points out, the lower end of the annular chamber was closed by a wall containing a number of holes normally covered by stoppers, which latter could be removed to allow the coke to be withdrawn through the holes. The present invention consists in a coke-oven of the above kind in which the lower end of the annular chamber, when it is being discharged, presents an unobstructed ring-shaped opening through which the coke in the chamber can fall.



Nelsen's Coke and Gas-Making Apparatus.

Fig. 1 (left half) shows a section through the coke chamber and heating flues; and on the right side a section through the regenerator. Fig. 2 shows a longitudinal section through a coke-oven modified to serve as a producer.

In the form of construction shown the heating gases are led always in the same direction through the flues, and so that, in both the inner and outer heating wall, the gases rise in one part of the heating flues and flow downwards in the others. In the corner spaces adjacent to the round "ovens" are arranged the air-heating means. The annular coke chamber A is surrounded by heating flues C partly in the inner member B and partly in the outer D. The heating gas passes from the pipe Z to the lower end of the outer heating flues and the upper end of the inner heating flues. The combustion gases, again flowing downwards in the second part of the outer heating flues, unite with the combustion gases of the inner heating flues coming through the passage E, and these gases together flow through the passage F into one of the regenerators G or H, and thence into the chimney pipe K; while the air for combustion flows into the passage L and one of the regenerators G or H, and into the passage M, from which it goes to the heating flues. The change-over of the regenerators for air or gas is effected by the control devices N and O. By means of the device O the upper opening of the regenerators is placed in communication either with the air passage L or with the chimney pipe K; and by the device N the lower opening of the regenerator is placed in communication either with the passage M or the passage E which are connected to the heating flues.

The shaft A is closed at the lower end by a bottom R (fig. 1) formed into a truncated cone or pyramid. The opening and the closing of the bottom is effected by hydraulic presses S. A tight joint of the bottom is obtained by a cord made of asbestos placed in the cast frame T. After the bottom is let down, the coke automatically slides over the shoots U to the transport devices V, is quenched there, and conveyed to its destination. The vapours produced by quenching are drawn off through the conduit W by an exhauster and discharged. The supporting structure on which the oven is mounted is tightly covered by an arch or lining, so that the quenching vapours cannot escape outside. The coking material is introduced through the filling opening P.

In order to enable the quantity of gas required for heating the oven, or for other purposes, to be manufactured from waste substances, in some of the ovens of a battery the bottom is replaced by a rotary grate Y (fig. 2). These ovens like the other furnaces are filled with coal slime, coke ashes, washing rubble or other combustible waste products, and the material is first coked. The gases thus generated are conveyed to the receiver X or to the heating gas pipes Z. After the material introduced has been properly coked, the grate Y is moved and steam or air (or a mixture of the two) introduced through the pipe L, and the coke gasified in known manner.

Regulating the Air Supply to Gas Producers and Retort-Settings.

BROOKE, T., of the Nechell's Gas-Works, Birmingham.

No. 18,705; Aug. 15, 1912.

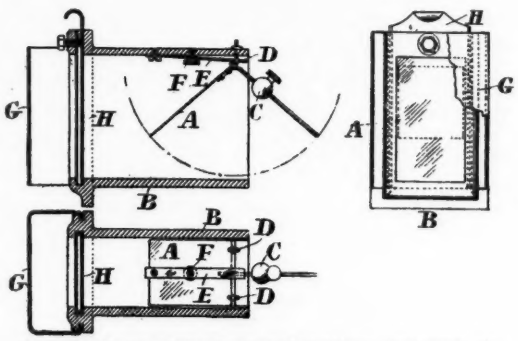
This invention relates to "the automatic regulation of the primary air supply which passes through the fire and generates producer gas, or secondary air supply admitted to burn the producer gas in the setting or places to be heated, or both, in connection with producers such as are in common use for heating horizontal, inclined, or vertical retort-settings. . . . Hitherto there has been no effective method of automatically regulating such primary and secondary air supplies so as to compensate for variations due to changes in the direction or velocity of the wind, chimney draught, or in the amount of resistance to the passage of the air through the fuel or flues."*

The object of the invention therefore is "to provide an improved

* This is the patented arrangement referred to by Dr. Davidson in the course of his "William Young Memorial Lecture" to the North British Association of Gas Managers, which appeared in the last issue of the "JOURNAL" (p. 689).

construction of draught regulator to automatically compensate for the variations, and so to prevent much of the waste of fuel that would otherwise take place, and incidentally to reduce the formation of clinker and to avoid its ill-effects."

The automatic regulator proposed is to be situated entirely in the flue, and comprises a vane pivoted freely in a continuous length of the air-flue and provided with an arm or rod projecting from the plane of the vane and carrying an adjustable weight. In this way, the amount of the air opening and the amount of movement of the vane due to the changes in pressure or vacuum can be adjusted at will. Provision is also made to prevent undue oscillation, and to avoid the closing of the vane beyond a certain limit by sudden changes in the pressure or vacuum.



Brooke's Air Regulator for Retort-Settings, Producers, &c.

A sectional elevation is given of a cast-iron flue box fitted with the mechanism, as arranged for automatically regulating the air passing to the furnace or combustion chamber; also a plan, and a front elevation with the wind-shield partly removed.

The regulator comprises a vane A mounted to swing freely within a cast-iron box B, and so regulate the supply of air. The vane is balanced by a counterweight C, mounted on a rod secured to the vane. It is shown substantially perpendicular, but is capable of being bent or adjusted to any desired angle. The counterweight is made adjustable in order that the amount of air passing the vane may be varied. The vane is suspended from the hinge D; and a plate spring E is provided to bear on the back of the hinge and so prevent excessive oscillation of the vane. An adjusting screw F is provided to allow of the variation of the pressure on the hinge.

In order to protect the vane from the effect of sudden gusts of wind, a wind-shield G is provided at the open end of the box; and a sliding damper H is provided (as shown) for use in the event of the controlling vane being put out of action.

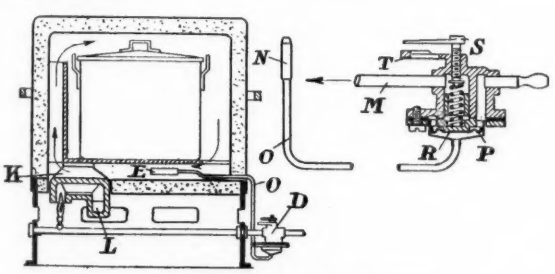
It will be seen, says the patentee, that the arrangement of the draught regulator is such that any increase in pressure of the air supply tends to close the box, and thus slightly restrict the passage of the air, and *vice versâ*. The draught regulator is suitable for use with gas producers, retort-furnaces, chimneys, or the like; and when used as a chimney-draught regulator the vane is mounted in an opening leading to the main flue and turned the reverse way round, so that it opens (instead of closing) with an increased pull, and admits more or less air to the chimney according to the draught.

Gas Cooking Ovens.

JUNKERS, H., of Aachen, Germany.

No. 26,192; Nov. 14, 1912.

This invention consists in the combination with a gas cooking oven, having heat-insulated walls, of a heat-transmitting device in which the products of combustion do not enter the cooking chamber, and an automatic device for maintaining constant the temperature within the cooking chamber.



Junkers' Gas-Stove Regulating Device.

The illustration shows a vertical section through one form of the cooking-apparatus; and a vertical section (enlarged) of the governing device.

The products of combustion do not directly serve the purpose of heating, but primarily act upon a heat receiving and transmitting device, consisting of a casing having an opening L for the escape of the gases of combustion, and provided with ribs K inside the cooking chamber to impart heat to the air in the interior of the apparatus, so that the hot air circulates as indicated by the arrows. The cap E is so arranged as to be protected from damage when the cooking vessel is inserted in the stove—being disposed in the space beneath the cooking vessel.

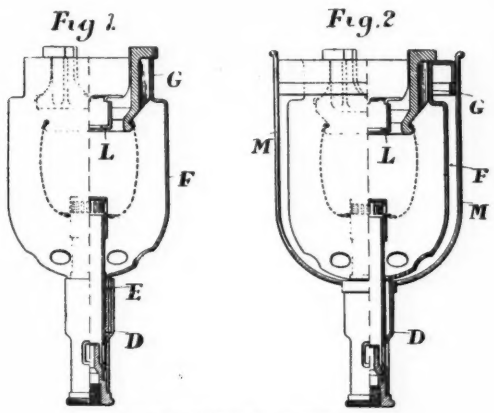
The governing device D is preferably constructed as shown. A vessel N (which may be identical with the cap E) is filled with a liquid which, on being heated above a definite limit, develops pressure, which is transmitted by a thin tube O to a diaphragm P. This closes the gas valve R which is normally held open by a spring, the compression of which may be varied as desired by the lever S moving over a graduated scale T. Thus the temperature at which the valve comes into action may be varied. C is the gas inlet to the governing device, and M is the gas-connection to the burner. In accordance with the temperature prevailing in the apparatus, the valve R is more or less displaced. It can, for example, temporarily be totally closed and then re-opened, in which case a bye-pass, uninfluenced by the closing of the valve, prevents the flame from completely going out, or an automatic ignition of the gas may be provided.

Incandescent Gas Lighting.

LANGHANS, R., of Berlin.

No. 28,501; Dec. 10, 1912.

The invention relates to an incandescent gas-burner with an inverted mantle, and the burner tubes entering the mantle centrally from below; the patentee proposing, in his patent No. 28,091 of 1911, to form the glass globe of the burner as the mantle support, "so that the space inside the mantle above the burner head is entirely free, and the illuminating capacity is not impaired in any way." The present invention relates to a further improvement in and development of this form of burner.



Langhans' Incandescent Burner.

In fig. 1, a sleeve D is fixed to the burner tube so as to be adjustable vertically. It serves for the reception of a neck E, fitting snugly around the burner tube of the glass globe F. At its upper part the globe is annularly offset inwards at G, so that the mantle ring to which the mantle is secured rests on this part by means of arms. To deflect the flame on to the wall of the mantle at its upper part, a guide L (a cylindrical or annular cap or disc) is suspended at the centre.

Contrary to what is the case in the construction described in the 1911 patent, in the construction illustrated in fig. 1 the neck E of the globe does not directly enter the guide sleeve D, but is rigidly connected with a metal sleeve cemented to it. The sleeve can be fitted exactly with friction into the guide sleeve D, which is not possible with a glass neck, so that, if a globe should break, it is not necessary to cement a new cylinder with neck into the sleeve, but merely to replace it by another globe with the metal sleeve permanently fixed to it.

In fig. 2 the globe consists of two parts, the glass globe F and a frame M, preferably of wire rods connected above and below by means of a ring. The lower of the rings is fixed to the sleeve D, while the globe F, by means of a downwardly directed annular extension connecting with the portion G, rests upon the upper ring. With this construction the globe may comprise a lower neck which enters the guide sleeve freely; but this is not essential, as generally speaking the guidance afforded by the upper annular extension is sufficient. The concentric guidance of the mantle ring is given in this constructional form also by means of ribs formed on the arm of the ring.

Tamping Apparatus for Pipe-Joints.

MARKS, E. C. R.; a communication from the American Calking Machine Company, of New York City.

No. 4791; Feb. 25, 1913.

This apparatus is for "rapidly and effectively" tamping the joints between sections of gas and water mains and the like. It "can be applied to the pipes already laid, and furnishes means whereby one or more power-driven tools may be moved along the working path in either direction, and whereby the tools may be withdrawn from, or pressed forward, to their work; also the interchange of engines and of tools is easily effected."

The patentee claims: 1. A tamping apparatus comprising a foundation frame adapted to be centred upon a pipe, and having a guiding track; an engine-carrying ring adapted to run in the track; a tamping engine carried by the ring; and means for causing the ring and engine to travel around the frame. 2. Apparatus made in accordance with claim 1, wherein means are supplied for moving the track upon slides transversely of the frame. 3. Apparatus made in accordance with claim 1, wherein one or more tamping engines are removably supported on the engine-carrying ring. 4. Apparatus made in accordance with claim 2, wherein a cam ring is employed, having suitable inclined slots co-operating with slides fixed to the track whose projections pass

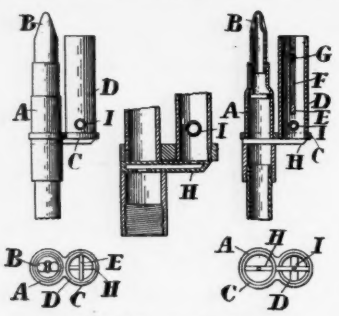
through the slots, whereby the turning of the cam ring causes movement of the track transversely of the foundation frame. 5. Apparatus made in accordance with claim 1, wherein a removable tamping engine sliding into place on the engine-carrying ring is engaged by a pivoted lever on the ring having a locking portion, whereby the tamping engine is held in place.

Gas-Igniters.

BARKER, R. W.; a communication from R. E. Berthold, of New York City.

No. 11,123; May 10, 1913.

This self-igniting device for gas-burners is one in which catalytic substances—such as spongy platinum or platinum wire—are supported in a chamber adjacent to the main burner, and rendered incandescent by the action of a mixture of gas and air (the gas issuing from a pilot tube), "thereby causing such mixture to break into a flame, which flame ignites the gas issuing from the main burner." The invention relates particularly to devices of this character wherein the turning on of the gas is sufficient to ensure its ignition without further trouble.



Berthold's Gas-Igniter.

A indicates an ordinary burner-tube with burner-tip B. Attached to the side of the burner-tube, by a band C, is a frame E having strung on it a number of fine platinum strands F, carrying one or more pellets of catalytic material G. A fine pilot tube H leads from the interior of the burner-tube to a position below the open tube D. The pilot tube has an opening within the burner-tube A to receive gas, and an orifice to permit a tiny jet of gas to ascend axially within the tube for the purpose of reacting, in the presence of air passing through the tube, upon the catalytic material. The flame within the tube D from the resulting incandescence of the catalytic material and the platinum strands serves as a pilot to ignite the larger volume of gas issuing from the burner-tip B.

To protect the catalytic material from the deleterious action caused by flame contact, a "flame protector" is employed, consisting of a transverse bar I between the gas-orifice and the igniter material. The bar serves to spread apart the pilot flame rising from the orifice whereby the flame is prevented from coming into contact with the igniter material, and whereby the heat zone within the tube D extends up at the sides of the igniter material, instead of taking a path axially through the tube and attacking the igniter material.

APPLICATIONS FOR LETTERS PATENT.

19,693.—BULLOCK, W., "Dry gas-meters." Sept. 1.
19,697.—ROLLASON, A., "Production of oils from coal, cannels, and shales." Sept. 1.
19,698.—POTTER, W. G., "Incandescent burners." Sept. 1.
19,708.—CRACKNELL, T., BRAND, A., and NORRIS, B. T., "Supply of gas to engines." Sept. 1.
19,775.—SHAW, E. J., "Pendants, &c." Sept. 1.
19,797.—EVERED AND CO., LTD., and BOXALL, J. E., "Inverted burners." Sept. 2.
19,799.—DRABBLE, H., "Geysers." Sept. 2.
19,851.—DAVIS, A. H., and ANTONI, E. W., "Geyser." Sept. 2.
19,852.—MORE, I., "Solution for mantles." Sept. 2.
19,862.—HERMANN, E., "Universal joint." Sept. 2.
19,872.—OFENBAU G.M.B.H., "Dry distillation of coal." Sept. 2.
19,943.—KILLAR, C. F., "Incandescent lighting." Sept. 3.
19,955.—STROMMENGER, W., "Recovery of tar." Sept. 3.
19,993.—KELLEHER, D., "Pipe-joints." Sept. 4.
20,048.—JACKSON, J. P., "Gasometers." Sept. 5.
20,092.—M'COURT, C. D., and BONECOURT SURFACE COMBUSTION, LTD., "Combustion of combustible mixtures." Sept. 5.
20,101.—COLLINS, H. E. & W. F., "Gas-fired furnaces." Sept. 5.
20,113.—AUBLET, HARRY, AND CO., LTD., and STANLEY, E. J., "Pressure gas-regulating fittings." Sept. 5.
20,158.—TAKEDA, K., "Dressing ores by gas." Sept. 6.
20,196.—UTLEY, W. H., "Rotary pumps, engines, or meters." Sept. 6.

Alleged Nuisance from a Gas-Works.—Last July, the Town Clerk of Stretford wrote to the local Gas Company complaining of an alleged nuisance from their works. The Company have now replied to the effect that they are surprised at the continuation of these complaints, as in their opinion the smoke, fumes, and dust given off from the works over any 24 hours are much less now than at any previous period, and that the works will compare favourably with any gas-works in the neighbourhood. At a recent meeting of the Council, it was decided that the Chairman of the Sanitary Committee should interview the Engineer af the Gas Company upon the subject, and report further.

LEGAL INTELLIGENCE.

GAS COMPANY'S RIGHT TO SELL THEIR PROPERTY.

Decision by the Massachusetts Supreme Court.

The following case bearing upon the right of a gas company to sell their property appeared recently, under the heading of "Legal Decisions Affecting Gas Companies," in "The Gas Age" (New York).

The Massachusetts Supreme Court discussed with great thoroughness the public service aspect of gas companies in its decision in a recent action where the Court was asked to restrain one gas company from selling their physical property to another. It was not proposed to sell the company's licences and permits, as the new company had these of their own. The transaction was for the purpose of avoiding and adjusting certain legal and financial difficulties existing between the old gas company, the city of Haverhill, and the Board of Gas and Electric Commissioners. The point at issue was whether the gas company had a right under the general law, without special authority from the Legislature, to sell their property, including the pipes and mains in the streets necessary to the carrying-on of the business, and thus deprive themselves of their facilities for doing business.

The Court quoted, as a succinct, clear, and comprehensive statement of the law, Chief Justice Knowlton's remarks in the opinion in *Weld v. Board of Gas and Electric Light Commissioners:* "The respondent is a corporation, organized to exercise a public franchise of importance to the community in which it conducts its business. It is its duty to exercise this franchise for the benefit of the public, with a reasonable regard for the rights of individuals who desire to be served, and without discrimination between them. It cannot relieve itself from this duty so long as it retains its Charter. It enjoys public rights in the streets, which are derived from the Commonwealth through action of the Board of Aldermen under authority of the Legislature. It is a *quasi*-public corporation, and as such it owes duties to the public. Without legislative authority, it cannot sell its property and franchise to another party in such a way as to take away its power to perform its public duties."

The Massachusetts Supreme Court has repeatedly held that the paramount right acquired by the public in land taken for highways includes the laying of gas-pipes. The Charter authority of a gas company to lay their pipes in public ways, though not in express terms made dependent upon such reasonable limitations and regulations as the Legislature might impose from time to time, was not absolute and unqualified in character, and was subject by implication to the general power of the Legislature over highways. It would be within the power of the Legislature to pass any reasonable restrictions at any time touching the use of the highway. This includes proper regulation of the conditions under which a gas company may use highways.

Gas companies are *quasi*-public corporations. The character of the functions performed by them, which is reflected in the evolution of the statute law, based upon common experience and the progress of civilization, stamps gas companies as public in the same sense as that in which street railways and other such corporations are public. On basic principles, they cannot sell or mortgage their property, so as to impair in any substantial degree their ability to continue to perform their public service, without legislative consent.

In regard to the question whether the gas company was authorized by statute to make such a sale, the provisions of the Massachusetts Act of 1886 relating to gas companies was construed. It provides that "no gas company shall transfer its franchise, lease its works, or contract with any person, association, or corporation to carry on its works, without authority of the Legislature." As applied to a gas company, the word "franchise" was held to mean the right to manufacture and supply gas for a particular locality, and to exercise the special rights and privileges in the streets and elsewhere which are essential to the proper performance of their public duty and the gain of their private emoluments, and without which they could not exist successfully. The old gas company did not propose to transfer to the new company anything more than their tangible physical property; but the Court held that they were practically making a surrender of all their franchises, without which the new company could not exercise the franchises necessary for the business.

It was held that, looking through form to substance, the proposed arrangement was the wiping-out of the old gas company and the substitution for it of the new corporation in the exercise of all its public duties, to be accomplished as parts of a single transaction. In essence, it was the same as a consolidation or direct sale, so far as concerns their practical manifestations in service to the public. A surrender of the old company's franchise for the benefit of the new one was, under the circumstances, the equivalent of a transfer of their franchise as those words are used in the Act. The Legislature had granted no consent to the transfer, but had prohibited it. The statute was held to be valid and constitutional, and within the powers of the Legislature over public service corporations. The sale was therefore restrained by the Court under its authority to restrain any corporation "from assuming or exercising any franchise or privilege, or transacting any kind of business, not authorized by the Charter of such corporation and the laws of this commonwealth."

VALUATION OF THE AIRDRIE GAS-WORKS.

The revision of the Corporation gas-works valuation has been a vexed question in the burgh of Airdrie for some years; and the matter has once more recurred at the annual valuation Court held by the Town Council.

The difficulty arises through the fact that there are two rating authorities—the Town Council and the Parish Council of New Monkland; the burgh being included in the assessable area of the latter for parochial rates. The Town Council constitute the Court for hearing

appeals from the Assessor's valuation; and the case for the Parish Council has all along been that, being the judges in their own case, the Corporation have been inclined to under-rate their gas undertaking to the detriment of the parish assessment. Last year, after prolonged contention on the matter, a compromise was arrived at; and it was fully intended that a final settlement of the questions in dispute should be arrived at this year. With a view to a *modus vivendi* being reached, a conference took place between Committees of both the Parish Council and the Gas Committee of the Corporation. The latter proposed to refer the matter to the Assessor of Railways and Canals for Scotland —namely, Mr. Jackson—who has experience in rating gas-works; but the Parish Council representatives declined to have a reference to him, and put forward several other names. The Gas Committee insisted on the Assessor of Railways and Canals, as being the arbiter referred to in the Act of Parliament. The result was that no reference at all was agreed to.

The Parish Council, at the Valuation Court, now lodged a complaint, in terms of section 13 of the Lands Valuation Act, to the effect that the Burgh Assessor's valuation of the gas-works, at £7040, was too low, and that it should be £7372. Against the Assessor's valuation, Mr. Dugald Currie (the Gas Engineer) entered an appeal by his Committee, to the effect that it was too high at £7040, and should not be more than £5141. Mr. Currie addressed the Court at some length in support of his contention, quoting the decision of the three Judges of the Court of Session in the Leith Gas Commissioners' case (1909), the latest judgment ruling on such questions as were involved here, and directing particular attention to the deliverance of Lord Low. He showed that he had made up the £5141 (which he asked should be the entry on the roll) upon the lines laid down in the decision referred to.

Mr. J. A. Reid, solicitor, on behalf of the Parish Council, asked to be allowed to produce evidence to substantiate the figure they put forward of £7372, or, alternatively that the Court should not fix the valuation at a lower figure than the Burgh Assessor had put forward—viz., £7040. The Parish Council, he said, went on the principle of deducting repairs; and this made all the difference between them and the Assessor, who, they considered, had really followed the Judge's decision.

After discussing the matter for about two hours, the Provost announced that the Court had fixed the rental for the year at £5500. This, it is understood, is again a compromise of the question; and it was stated that next year the Corporation will call in the Assessor of Railways and Canals to give the valuation of the works, so as to put the matter beyond further dispute.

A stated case for appeal was asked for the Parish Council.

MISCELLANEOUS NEWS.

WELL-KNOWN FIRM RETIRE.

At the end of last week, much interest was excited by rumours (subsequently officially confirmed) of the impending closing-down of the works of Messrs. John Aird and Co.; Sir John Aird, the second baronet, who succeeded his father in 1911, having decided to give up business, though contracts already entered into will be completed. The firm have, of course, for many years possessed a world-wide reputation as Contractors; but apart from their widespread business relations with gas and water undertakings, the name has been connected with the gas profession by the fact that the late Sir John Aird, Bart., was a Director of the Gaslight and Coke Company.

The history of Messrs. John Aird and Co., from the inception of the business to its present-day greatness, is a wonderful one. The firm was founded in 1848 by John Aird, a mason, who had come to London from Ross-shire and settled at Bromley-by-Bow. He had been for twenty years Superintendent of the station of the Phœnix Gas Company at Greenwich; and in 1848 he started as a contractor on his own account. The big towns were then undertaking works for the supply of gas and water; and Mr. Aird was one of the earliest contractors in London for the erection of gas-works and the provision of water-mains. His son, John Aird, who became member of Parliament for North Paddington, subsequently vastly extended the operations of the firm. His first important undertaking was the removal of the Crystal Palace from Hyde Park to Sydenham. Following this, his firm undertook large water-works constructions on the Thames, and at Amsterdam, Copenhagen, and Berlin; and gas-works in Russia, France, Italy, Denmark, and Brazil. Messrs. John Aird and Co. were also associated with the Beckton works of the Gaslight and Coke Company. In 1860, the firm amalgamated with that of Messrs. Lucas, under the title Lucas and Aird; and shortly thereafter the combined Company entered upon the work of contracting for railways and docks, &c. After 1895 the Lucas interest disappeared; and it was under the old style of John Aird and Co. that the largest of all the firm's undertakings was carried out—the construction of the great Nile dams at Assouan and Assiout.

The late Sir John Aird left a fortune of over £1,000,000.

MR. GOODENOUGH'S LECTURES ON GAS AS A FUEL.

More Criticisms Answered.

In the issue of the "JOURNAL" for the 2nd inst., we reproduced from the "Journal of the Society of Arts" some letters containing criticisms of the Cantor Lectures delivered by Mr. F. W. Goodenough, the Controller of Sales of the Gaslight and Coke Company, before the Society early in the year, together with his reply to his critics. The following additional letters have appeared and been answered by Mr. Goodenough.

As neither my wife nor I are in any way connected with any gas company, nor with the Society of Coal Merchants, and have no axe of any kind or shape to grind, it may interest your members, and incidentally Mr. Goodenough, to read our experience with gas-fires for domestic purposes. In order to reduce work to a minimum, we decided, when settling in this flat, to try gas-fires in the following rooms: (1) Kitchen, for cooking; (2) bedroom; (3) dining-room; and (4) study. We may state at once that the use of gas in the kitchen has been on the whole satisfactory. For the comparatively small amount of cooking we require, it is not more costly than coal; and the facility with which it can be controlled and the heat of the oven regulated give it a material advantage over a coal-fire. Its disadvantages are that in cold weather the maid still has to have a coal-fire for warmth and comfort, and that there is a lack of hot water for the bath and other purposes. It would, of course, be possible to use gas for both warming the kitchen and providing hot water; but, in our experience, these would, as compared to coal, be by no means economical. Nevertheless, in spite of these disadvantages, a gas-cooker is distinctly a thing to have.

As regards gas-fires in ordinary rooms, we started, as stated above, with three. In each case the grate selected was recommended by the gas company, and was fitted by them; and, after a trial extending over eighteen months, we have reverted to coal-fires in bedroom and study, and only have a gas-fire in the dining-room. The dining-room is a small room of some 1500 cubic feet capacity. We use it only for meals, and though the gas-fire by no means gives us complete satisfaction, we retain it, as it saves work, and, owing to the short time it is lighted, is hardly more expensive than a coal-fire, when the latter is kept in all day.

For both study and bedroom, the gas-fires proved quite unsatisfactory. The former is a small room of about 1500 cubic feet capacity, and it was possible to warm it sufficiently with the gas-fire installed. But we found it was very expensive compared with coal; that it certainly caused a feeling of heaviness—in my wife's case it always caused a headache—if the room was occupied for more than an hour or so at a time; and that the glare from the fire was disagreeable, if not harmful, to the eyes. As regards the cost, we found that the grate—a small one—consumed not less than 25 cubic feet of gas per hour; and, burning eight hours per day at 2s. 5d. per 1000 cubic feet, cost 3s. 5d. per week. A coal-fire, giving equal warmth and much more comfort, costs about 1s. per week.

The bedroom is larger—about 2200 cubic feet capacity—and our experience was that the gas-fire, though stated to be amply large enough, failed to heat it adequately, and was expensive. The consumption was 35 cubic feet per hour, and, as the fire was lighted about 7.30 p.m., and put out about 10.30 p.m., the weekly cost was about 1s. 10d., against about 9d. with coal. Lighted at 7.30 p.m., with the thermometer at 50° Fahr., by 10 o'clock the temperature of the room had risen to from 52° to 53° only; whereas with a coal-fire lighted at 7.30 p.m., and well made-up about nine o'clock, by 10 o'clock the thermometer registered from 57° to 58°. The coal-fire had the further advantage that, by making it up properly before getting into bed, and backing it with slack, it would stay in all night, and prevent the room becoming unduly cold.

Having tried gas-fires, we find that (*a*) they are, compared to coal, very expensive; (*b*) for the gas burnt they are not effective; (*c*) they undoubtedly affect the air of a room and cause heaviness, and in some cases headaches; and (*d*) they are noisy, as all the stoves we have either tried or inspected make an irritating hissing noise. This last fault, in our opinion, makes a gas-fire particularly inappropriate for a bedroom or a sick-room. The noise is in many cases no doubt slight, and when one is interested in conversation or in work might pass unnoticed; but in the quiet of the night it is distinctly noticeable and disagreeable.

J. FORREST BRUNTON, M.Inst.C.E.

As Mr. Goodenough, instead of replying to my questions, has seen fit to try to drag the Society of Coal Merchants into this discussion, will you permit me to add a few words to my last letter?

I do not happen to be one of the Committee of that Society, and therefore cannot be held responsible for their decision to reply to the present campaign of the gas companies. The truth is that, after the said Committee had appointed a Sub-Committee to deal with the matter, I was asked by them to join the Sub-Committee as a co-opted member (probably because it was known I had already made some investigations in this matter); and, at the invitation of its Chairman, I later agreed to act as Secretary for the Sub-Committee.

Mr. Goodenough unduly flatters himself if he looks upon the coal merchants as in a state of panic in the ordinary way about gas or any other rivals of coal. But it happens that within the last few years there has come into existence an institution calling itself the British Commercial Gas Association. The sole object of this institution would appear to be to act as a gigantic puff for gas, and incidentally to throw mud at all its rivals. They evidently believe in the saying, "If you persist in telling people they require a thing, they will end by believing they really do want it." In pursuit of this policy, they have already spent very large amounts, and are spending a further £15,000 this year.

I note Mr. Goodenough says none of the stoves used at his lecture were supplied with flues, and it therefore appears to me that they formed a very inept illustration from the lecturer's point of view, and it would have been better had they never been lit. He omits to mention that, in dealing with medical men, it is a habit of gas companies to worry them to be allowed to instal gas-stoves for them *free of cost*.

A freshly installed gas-stove may be capable of carrying off most of its products, as Mr. Goodenough states; but one cannot help noticing that after some time the mouthpieces begin to fur-up and collect dust, and so interfere with proper combustion.

In regard to gas lighting, it has, I think, always been admitted that it is dirtier than gas heating; but the latter is, nevertheless, still an offender.

Referring to the first part of his letter, it may interest him, and also Mr. Pither, to know that I employ an anthracite stove in my nursery, as being the safest method of heating. It consumes just a ton throughout the winter, burning day and night, and produces regular and sufficient heat to keep the room properly warmed, with the window always open

at the top—a state of things I have never found possible with a gas-stove. As to health, I think it is sufficient indication that with three children my doctor's bill for the past year amounted to the nominal sum of £2.

With respect to hot-water supply and cooking, the best method would appear to be along the lines of the K.B. Thrift Range. In this range the boiler is in the fire itself, consequently the water cannot help being hot. The fuel is fed from the front, not the top; roasting can be done by radiant heat beneath the fire, and the ovens are superimposed one above the other, and so arranged that the heat may be made to pass to one or both of them, or be completely cut off at will. One is also enabled to burn a lot of the rubbish which ordinarily gets deposited in the dustbin, and so breeds obnoxious flies.

HYLTON B. DALE.

There is one practical point which the advocates of gas-fires and incandescent mantles should never cease to impress upon the public—that is, that the burner or burners must never be allowed to "fire-back."

I have often been surprised at the numbers of educated men I have met who do not understand the principle of the bunsen burner. Among housekeepers and servants of the other sex, I cannot recall ever meeting a single person who was able to connect an evil smell from a gas-burner with the fact that it had "fired-back." A leaflet containing a statement on the subject should be given away with every burner sold.

J. W. E. COLE, M.D.

Mr. Goodenough, to whom proofs of the foregoing letters were forwarded, wrote in reply:

I do not think Mr. Forrest Brunton can have read these lectures very carefully—an omission for which I should be the last to blame him—or he would have realized that I did not claim that, hour for hour, a gas-fire could compete in cost with a coal-fire.

What I did claim, and what the quite unprecedented increase in the use of gas-fires by almost all classes of the public in recent years has proved, is that, taking the household budget as a whole, and having regard to its many advantages—of control, of saving of labour and dirt, of instant readiness, of reliability, &c.—the gas-fire is superior to the coal-fire, even when it causes the direct fuel bill to be greater. Household economics, like national economics, must be studied as a whole, not in fragments.

Mr. Forrest Brunton's experience in regard to the efficiency and effect upon the air of a room of gas-fires differs from that of an enormous number of other people. He may be assured that the faults which he experienced are not inherent in the modern gas-fire, and that he is the victim of indifferent service. If he will communicate direct with me, I will do my best to prove this to him in a practical way.

Mr. Hylton Dale denies that the Society of Coal Merchants are in a state of panic, and then proceeds to explain the cause of their recent alarm by uncomplimentary references to the British Commercial Gas Association. Anyone who has compared the publicity work of that Association with the recent circular of the Society of Coal Merchants will appreciate the delightful humour of Mr. Dale's suggestion that the Association employs its energies in throwing mud at all its rivals! But I need not say anything myself in defence of the Gas Association's methods of publicity, for I can quote from an authority above all suspicion of favouring the gas industry.

The "Electrician," writing of the British Commercial Gas Association on Oct. 11, 1912, said: "This organization . . . exists for the express purpose of co-ordinating and distributing data which will be useful to the technical gas man and gas engineer. It has got into working order an important section of its organization which is purchasing space in the daily papers and illustrated weeklies, and filling this with attractive and forceful advertising matter . . . *There is no abuse of competitors;* and, with a few exceptions, there is very little exaggeration of fact."

This is not an isolated testimonial from its competitors to the policy of the Association. I can understand Mr. Dale's feelings; but he should be a little more careful as to his facts, as, for further example, when he states that "it is a habit of gas companies to worry medical men to be allowed to instal gas-stoves for them *free of cost.*"

Every gas stove or fire installed for medical men by the Company with which I am connected—and the number runs into many thousands—has been purchased or hired by those medical men on the same terms as those upon which the other members of the public can purchase or hire similar stoves or fires. The Company only do the work of fixing gas-fires free of cost for medical men—a policy they adopted with a view to inducing doctors who had doubts as to the hygienic advantages of gas heating to make a trial of modern gas-fires without risk of expense to themselves *if the experiment proved a failure.*

The result has been that several thousand gas-fires, fixed on trial at our risk for medical men, have proved themselves so perfectly satisfactory that the doctors subsequently have purchased or hired them, have afterwards added repeatedly to the number they use, and have written scores of letters testifying to their satisfaction, and stating that they have been converted by experience from prejudice against, to a strong advocacy of, that method of heating.

I am indebted to Mr. Hylton Dale for the opportunity of stating these facts, of which he and any other of your readers can see abundant proof if they will honour me with a visit.

As to anthracite stoves, I need add nothing to the opinion respecting them of Professor Leonard Hill, whose authority I am sure Mr. Dale will recognize. For myself, I can only say of an anthracite stove what Abraham Lincoln said of a novel that was once sent him for criticism: "People who like this sort of thing will find this the sort of thing they like."

F. W. GOODENOUGH.

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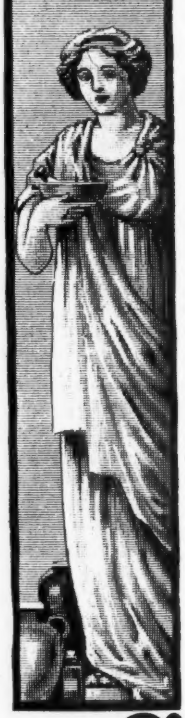

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WATER-GAS PLANT AT WIGAN.

An application of the Wigan Borough Council for sanction to borrow sums of money for various purposes formed the subject of a Local Government Board inquiry last Tuesday.

Among the amounts required was one of £3200 in connection with the gas undertaking; and this, it was explained, was for the duplication of the carburetted water-gas plant. The Town Clerk (Mr. W. H. Tyrer) added that the capital sanctioned for the whole undertaking was £409,329, and the amount expended £395,716. Mr. F. Betley (the Gas Engineer) stated that the average proportion of carburetted water gas used with the coal gas was about 6 per cent. In further putting the case before the Inspector, the Town Clerk remarked that the existing coal-gas plant was capable of producing 2,325,000 cubic feet per diem, if all the retorts were going, which was never the case. The heaviest day's output last year was 2,416,000 cubic feet on Dec. 24. This had been several times exceeded in previous years. The heaviest day's make had been 1,972,000 cubic feet of coal gas and 280,000 cubic feet of water gas, which gave the proportion of water gas as 12·4 per cent. The carburetted water-gas plant was erected in 1908, at a cost of £6593, and paid for out of revenue; but the cost of such plant had been materially reduced since then. The capacity of the present water-gas plant was 700,000 cubic feet per day of 24 hours' working; but it was not in operation more than eight or ten hours. The object of duplicating was to maintain the supply in the event of a breakdown; and another reason was that the gas consumption was steadily increasing in Wigan. The total sales showed an increase this year representing 8·5 per cent.; and the gas manufactured for the year ending March 31 last was 491,608,000 cubic feet. During winter, when both plants were in use, the Corporation had practically no stand-by; and for this reason the Gas Committee decided to extend the plant. If the carburetted water-gas plant broke down in winter, they would at once be placed in a difficulty in supplying the area within their statutory obligations. Inasmuch as the carburetted water-gas plant was procured out of revenue, no limit had ever been placed upon the Corporation as to the percentage of water gas, compared with coal gas, to be used.

The Inspector (Mr. T. C. Ekin) remarked that, when a loan was obtained through the Local Government Board, the Board fixed a limit of 33 per cent. Mr. Betley stated that only once had this point been exceeded; and it was on an occasion when the larger part of the coal-gas plant was standing. The Town Clerk pointed out that the average for the year was 9·5 per cent. Mr. Betley said he was under the impression that in two other towns the average was as much as 16 per cent. for the hours between 6 p.m. and 6 a.m. Roughly speaking, it was 6 per cent. at Wigan. It was exceeded at the time of the coal strike. Alderman Ashton said the Corporation would give an undertaking not to exceed 33 per cent. The Inspector here remarked that yearly averages were not acceptable. A whole town might be poisoned in a couple of days by carbon monoxide, and the rest of the year the supply might consist of coal gas. This was the reason why the Board would not sanction a loan for carburetted water gas unless there was a stipulation that the supply would not exceed 33 per cent. Alderman Ashton said the Council would at their next meeting pass a resolution in conformity with the Inspector's suggestion that not more than 33 per cent. be used. He added that probably next year the Corporation might have to extend the coal-gas plant.

There was no opposition to the application.

NOTTINGHAM AND METER-RENTS.

In curious contrast with the up-to-date methods which characterize the main scope of their operations, it is complained at Nottingham that the policy of the Corporation Gas Committee in relation to one aspect of their works is marked by conditions which are decidedly archaic. The point arises in regard to the continued maintenance of meter-rents; the criticism being that, with the single exception of Bradford, Nottingham is the only large Provincial centre in which these charges are now imposed. The matter has been more than once brought before the Council; but, despite repeated appeals, the Committee have so far proved unyielding.

The question was again broached at last week's meeting of the Council, when Mr. J. H. Gregg moved that it should be an instruction to the Committee to discontinue the meter-rents at the close of the present quarter. He pointed out that many consumers had had meters for over a quarter of a century, and had, therefore, in the way of rent, paid for their cost over and over again. Alderman Radford, while formally seconding the resolution, did so for the purpose of asking Mr. Gregg to postpone the request to the Committee until the close of the financial year. He agreed that meter-rent charges were now nearly obsolete, but said the increased prices of coal were likely to seriously affect the profits of the undertaking during the present twelve months. It would be desirable, therefore, to postpone the change until the beginning of the new financial year—a view of the situation in which Mr. Gregg acquiesed by consenting, somewhat reluctantly, to withdraw his proposal. At the same time, he suggested that the enhanced price of coal might probably be more than compensated for by increased consumption of gas; while he also pointed out that the cost of production had been considerably lessened. Judging from the feeling of the members of the Council, it appears tolerably certain that a material modification of Nottingham meter-rents, if not their entire abolition, cannot be much longer delayed.

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LEYDEN MUNICIPAL GAS UNDERTAKING.

Report for the Year 1912.

We have received from de Heer N. W. van Doesburgh, the Manager of the gas and electricity works of the Corporation of Leyden, a copy of the report of these undertakings for the year 1912. The following particulars relating to the gas-works have been abstracted from the report, which is of a very comprehensive and detailed character.

The accounts for the year show a gross profit on the working of the gas undertaking of 148,791·16 fl. (£12,399 5s.), and after paying interest and redemption charges a net profit of 58,565·71 fl. (£4880 10s.). The net profit is about £396 higher than in 1911.

The carbonizing plant of the works comprises 19 beds of 8 retorts; and there are in addition two sets of carburetted water-gas plant. Various renewals and repairs of both the carbonizing and water-gas plant have been made during the year. New offices for the gas undertaking were opened in June last. The total length of mains is now 50·5 miles. In addition, there are supplied from high-pressure mains suburban distributing systems with a total length of 25·8 miles of main.

The coal carbonized during the year amounted to 29,796 metric tons, of which 5072 metric tons were English, and the remainder Westphalian coal. The average cost of the coal delivered into store was 14s. 10d. per English ton, as compared with 14s. 4d. per ton in 1911. The average make of gas per ton of coal carbonized was 11,282 cubic feet, which is 266 cubic feet more than in the previous year. There were consumed in the manufacture of carburetted water gas about 521 metric tons of gas oil, of which the average cost was 83s. 6d. per English ton, compared with 54s. 5d. per ton in 1911. The consumption of coke in the manufacture of carburetted water gas was 49·3 lbs., and of oil, 20·3 lbs., per 1000 cubic feet. The figure given for coke includes the consumption both in the generators and under the boilers. The total production of gas in the year was 387,341,854 cubic feet, of which 85·41 per cent. was coal gas, and the remainder carburetted water gas. The production represents an increase of 7·52 per cent. on that for the previous year. The increase in the gas sold, as distinct from the gas made, was 7·07 per cent.

The number of ordinary consumers' meters in use increased by 397, and of prepayment meters by 974 during the year. Of the total output of gas, 59·68 per cent. was disposed of through ordinary meters, 23·11 per cent. through prepayment meters, 4·50 per cent. for street lighting, and the remainder to suburbs and for special purposes. The unaccounted-for gas amounted to 4·85 per cent. of the make, as compared with 4·35 per cent. in 1911. The price of gas to ordinary consumers for all purposes was 5½ cents per cubic metre (= 2s. 7d. per 1000 cubic feet). The average price obtained for coke was about 18s. per ton, and for coke breeze 5s. 3d. per ton. The receipts from sales of coal tar and sulphate of ammonia were higher than in 1911.

The average calorific power of the mixed gas was 610 B.Th.U. per cubic foot, as compared with 591 B.Th.U. per cubic foot in 1911. The sulphur in the gas averaged 28·3 grains per 100 cubic feet, the maximum being 39 grains. The proportion of ammonia in the gas distributed averaged 0·24 grain per 100 cubic feet.

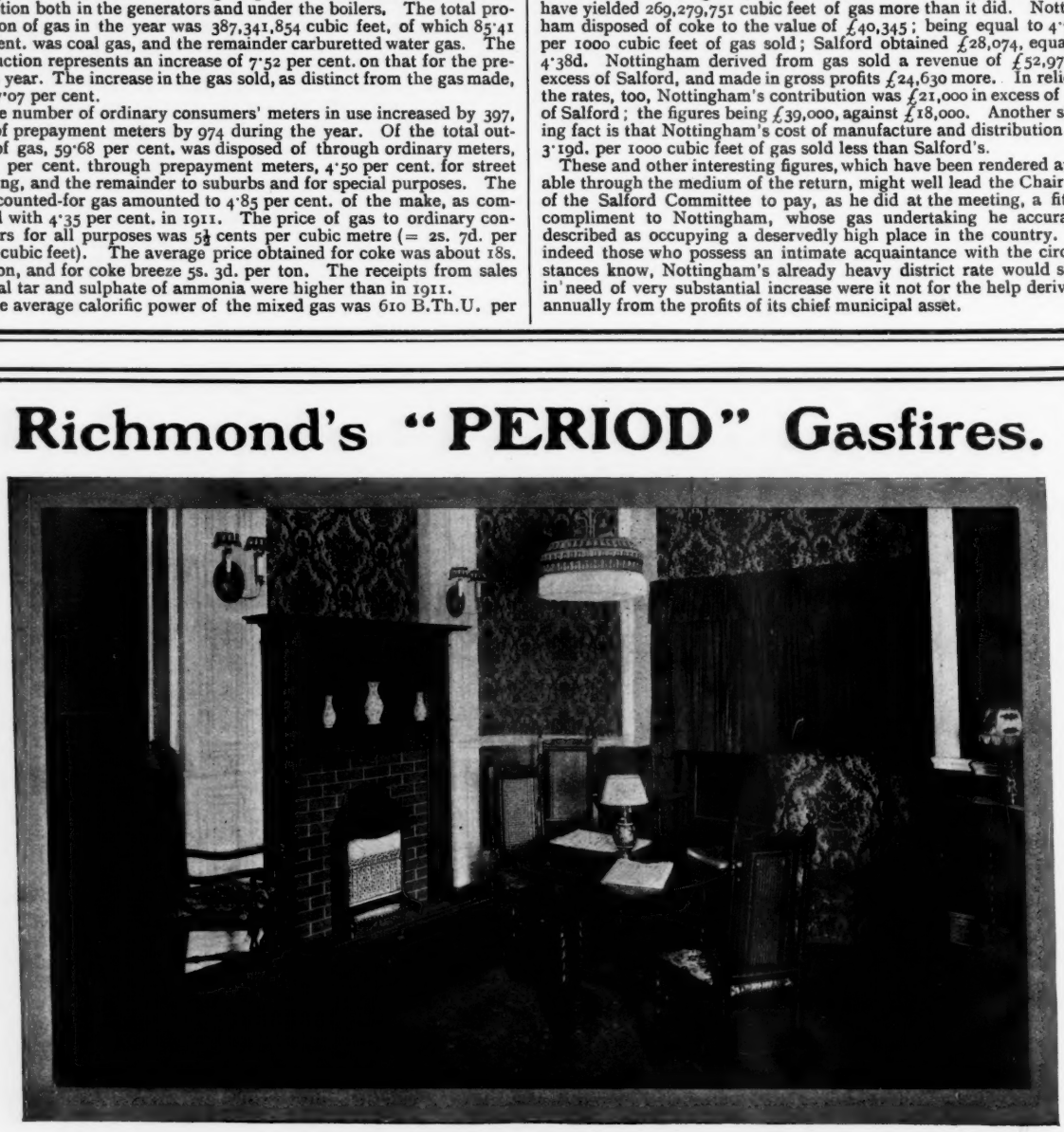
CORPORATION GAS UNDERTAKINGS CONTRASTED.

Comparisons are not always of a nature calculated to arouse the pleasantest feelings; but considerable gratification has been occasioned at Nottingham by some recent utterances of a member of the Salford Town Council, wherein the results of the management of the Corporation gas undertaking at that place have been contrasted with those at Nottingham, to the great advantage of the latter city. The metropolis of the lace industry, which established a record last year in relation to gas profits, has reason to be proud of its largest municipal trading concern; and the feeling may well be accentuated by the contrast which has just been afforded. Speaking at a recent meeting of the Salford Council, Mr. P. Hampson was responsible for some drastic criticism of local arrangements; and the considerations involved being largely based upon an examination of Nottingham's more profitable methods, a useful purpose has since been served by the publication of many interesting facts and figures.

It is pointed out (*inter alia*) that Nottingham bought its coal and cannel at 1s. 1·8d. per ton less than Salford, which means that the latter paid £9378 more for its coal in the aggregate than Nottingham. It is asserted also that whereas Nottingham accepted the lowest tenders, Salford did not, but "negotiated" and paid "fancy" prices. Nottingham produced 1651 cubic feet of gas more per ton of coal and cannel than Salford. If Salford had produced the same quantity of gas per ton of coal as Nottingham, the carbonization of the 163,101 tons would have yielded 269,279,751 cubic feet of gas more than it did. Nottingham disposed of coke to the value of £40,345; being equal to 4·72d. per 1000 cubic feet of gas sold; Salford obtained £28,074, equal to 4·38d. Nottingham derived from gas sold a revenue of £52,977 in excess of Salford, and made in gross profits £24,630 more. In relief of the rates, too, Nottingham's contribution was £21,000 in excess of that of Salford; the figures being £39,000, against £18,000. Another striking fact is that Nottingham's cost of manufacture and distribution was 3·19d. per 1000 cubic feet of gas sold less than Salford's.

These and other interesting figures, which have been rendered available through the medium of the return, might well lead the Chairman of the Salford Committee to pay, as he did at the meeting, a fitting compliment to Nottingham, whose gas undertaking he accurately described as occupying a deservedly high place in the country. As indeed those who possess an intimate acquaintance with the circumstances know, Nottingham's already heavy district rate would stand in need of very substantial increase were it not for the help derivable annually from the profits of its chief municipal asset.

Richmond's "PERIOD" Gasfires.



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LIMERICK ELECTRIC LIGHTING QUANDARY.

Heavy Deficit and the Method of Meeting It.

At a Special Meeting of the Limerick Corporation last week, Alderman M'Neice drew attention to the bank account, and mentioned there was a debit item of £1285 against the electric lighting revenue account. He asked what the Council intended doing by way of discharging the rate of 8d. per unit disallowed by County Court Judge Law Smith in the case of O'Brien *v.* the Council, as reported in the "JOURNAL" for June 10 (p. 753). Were they going to increase the cost per unit?

It was explained that Counsel's opinion had been taken as to the decision of the County Court Judge, which the Council believed to be a mistake; but the Local Government Board for Ireland had declined to take proceedings by way of mandamus—suggesting, however, that proceedings be taken by a friendly ratepayer, the costs to be borne by that person. If, said Mr. Dundon, the charge per unit were increased according to the maximum in the schedule, it was believed that it would result unfavourably to the electrical undertaking, and, in point of fact, ruin it. It was, he added, for the Council now to take proceedings by *certiorari*, and for a friendly ratepayer to proceed by mandamus. The Mayor said if they had to increase the cost of the electric light, it would mean an end of the undertaking, and the ratepayers would have to meet the deficit. Mr. O'Brien remarked that the County Court Judge had stated that the amount should be raised that would be necessary to meet the deficit. If the requirements went beyond 8d. per unit (the maximum charge), then the rates would be liable. He wanted to know whether the Local Government Board said that they could pay the expenses of the friendly ratepayer.

Mr. Dundon was understood to reply that the Board would raise no objection. Mr. O'Brien urged that the consumers of electric light were getting it at the expense of other people. There was applause in the public gallery when he went on to contend that, in taking action against the Council in respect of the electric light deficit, he had the ratepayers entirely with him. Alderman M'Neice said, with regard to the deficit for the coming year, the County Court Judge had stated that 1d. would provide it. He fully endorsed the opinion that, if the Council charged 8d. per unit, all the consumers would leave the department. Under the Provisional Order, if only one consumer remained the works would have to remain open, and all the employees be kept on as usual.

The Council took no action; it being understood that the Law Adviser would give the issues involved his careful attention.

The Gas Committee of the Bradford Corporation have decided to advance the wages of mechanics, fitters, blacksmiths, &c., in the Gas and Chemical Departments by 1s. per week in each case.

USE OF TAR IN ROAD MAKING.

A Reply to Scaremongers.

Presiding at the Annual Conference of the Sanitary Inspectors' Association at Llandudno last week, Sir James Crichton Brown delivered an address, in the course of which he dealt with dust as a danger to public health, with special reference to road dust.

After remarking that road dust had become a wide-spread and in some places intolerable nuisance, calling for prompt attention, the President said the best and most dustless roads were those which owed their virtues to tar bitumen or petroleum pitch in some combination; and it might be well, therefore, to allay the anxieties which the scaremongers had begun to conjure up. They had been told that the extensive use of tar in road-making must lead to a great increase of cancer, which was already so sadly prevalent. It was quite true that workers in tar and paraffin were liable, like chimney-sweeps, to a special form of cancer, and that men employed in the production of anthracene, which was the last product of the distillation of gas-coal tar, were especially prone to suffer from warts and skin eruptions, and occasionally from epitheliomatous ulcerations, which were a variety of cancer. The subject had been ably investigated by Dr. H. C. Ross, who concluded that the dangerous principles were contained in the heavy oils of the coal tar, or in some member of the amidine group which came off in distillation at about the same temperature as anthracene oil, and was present as an impurity in rough anthracene cake. The deleterious ingredient, Dr. Ross suggested, was really some vegetable organism which perished long ages ago, while the coal measures were being deposited upon the earth; so that it was the chemical action of decomposed organisms of the Carboniferous Period which brought about the warts and cancer of pitch-workers to-day.

Further investigations were now going on; but in the meantime it might be safely affirmed that there was not the remotest risk of the dissemination of cancer by the use of tar in road-making. It was, it would appear as the result of experiments, only certain kinds of pitch that were mischievous. That obtained from gas-works tar was so, but not that from the tar of blast-furnaces. Tar oil containing carbolic acid was innocuous; but it became mischievous when the acid was extracted from it. Pure anthracene oil was not mischievous; but the commercial rough anthracene cake was so. Then it was only, it would seem, by the repeated or constant application of the noxious material in some concentration to the skin for years that the skin was prepared for the occurrence of cancer; and no such application was possible through the dust of tarred roads. The only conceivable cancer tragedy in connection with such an atmosphere would be in the case of a chauffeur constantly passing through it with a sore on his lip. Among the hobgoblins that the deep-seeing eye could discern in the dust-clouds that now so copiously swept along or hovered over the highways was assuredly not that of cancer.

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THE FEAR OF FUSED CABLES.

A Board of Trade Inquiry to be Held.

Complaint was made by a member at last week's meeting of the Hebburn Urban District Council of several cases recently of fusing of electric cables in the town, to the danger of residents. He instanced a case in which his house, and that of his neighbour, were filled with the smell of bitumen during the night. There was every ground for fear, he said, that there would be other explosions such as that which occurred in Lyon Street, by which property had been destroyed and two lives lost.*

Several other members urged that strong representations should be made to the Electricity Company on the matter; and the Clerk was instructed to communicate with the Company, as well as with the Board of Trade. The Clerk thereupon stated that the Board of Trade intended to hold an inquiry in London; and he was directed to ask that the inquiry should be held in Hebburn, "where people who are afraid of their lives can give evidence."

* Full particulars of this disastrous occurrence will be found in the "JOURNAL" for April 29 and May 6 last, pp. 348, 388.

THE POSITION OF NITRATE OF SODA.

[From the "Chemical Trade Journal," Sept. 13.]

Not only were the August shipments to Europe announced by the Chilian Nitrate Committee as having been 142,407 tons, against 113,943 tons in the same month last year, but in a subsequent official circular they were stated to have been 156,770 tons. If the latter figure is the correct one, the "visible supply" (stocks and afloat) for Europe comes out at 515,470 tons, compared with 418,380 tons on Sept. 1, 1912; another steamer cargo—supposed to have gone to the United States—having come to this side of the Atlantic. The surplus visible supply is therefore already 82,747 or 97,090 tons, as the case may be; the "invisible" stocks on the Continent are at least 15,000 tons larger than at this time last year; and, to complete the picture, the quantity of nitrate available in Chili is 42,840 tons larger. Last month's output beat all records at 242,830 tons; making the stock there 726,250 tons, against 683,410 tons a twelvemonth ago.

In order to counterbalance this superabundance of supplies, the nitrate producers—at least, a majority—have decided to restrict, not the "shipments," but the output of their oficinas during five or six months (the exact period seems to be uncertain, and, moreover it is immaterial), to the extent of 93,130 tons. The situation borders on the ludicrous; and the absence of effect on the market of the new "combination" is not to be wondered at. The value of nitrate for autumn shipment has nominally advanced to 8s. per quintal f.o.b. (compared with 8s. 9¼d. at this time last year); but so disgusted are the Chilian producers at the anti-climax, that they are said to contemplate a "boycott" of buyers unwilling to pay high prices! A week ago they were anxious sellers at 7s. 11½d.; and a week hence they may be glad to accept even less money, in spite of the announcement by cable from Chili of "an increase of nearly 200,000 quintals" (9000 tons), under ½ per cent., in the world's consumption in the past eight months.

DERWENT VALLEY WATER SCHEME.

Defects in the Works—Further Expenditure Needed.

It would be hard to find a parallel to the constantly recurring difficulties which are being experienced in relation to the Derwent Valley water scheme. The project in which the municipalities of Sheffield, Nottingham, Derby, and Leicester are interested, has already led to serious conflict of opinion as to the apportionment of cost among the Corporations concerned; and now to the expensive process of litigation thereby involved have been added unanticipated engineering difficulties which are likely to entail further substantial calls on financial resources.

Among the many interesting details presented on the occasion of the opening of the first section of the works, few received greater prominence than the elaborate precautions adopted by means of wing-trenches to secure the water-tight character of the work. But it now appears that the reliance placed originally upon the security of the arrangements at all points has not been justified by experience. The result is that, though one reservoir has been filled and has been in service for a year, the second still retains its characteristics as a picturesque valley through which the Derwent continues its course. The completion was long since witnessed of the huge dam which is designed ultimately to hold up the water, and transform the valley into a lake nearly two miles long and half-a-mile wide. But recently it was discovered that the strata of the hillside are so shattered that, unless further trenches are constructed as wings to the main dam, huge quantities of water must escape through fissures in the ground. The matter is dealt with in a report which was presented at last week's meeting of the Nottingham City Council, which authority has more than once of late had occasion to regret its participation in the scheme, the cost of which, so far as it is concerned, might, as recent discoveries have shown, been entirely obviated by the exploitation of resources nearer to the City's own boundary. The report, pointing to a further estimated expenditure of £32,000, embodies the results of the investigations and recommendations of Mr. James Watson, M.Inst.C.E., the Water Engineer to the Bradford Corporation, and Mr. Edward Sandeman, M.Inst.C.E., the former Engineer to the Water Board; and though it is evident that the additional expenditure will not be relished by any of the authorities concerned, it is made clear that the outlay is inevitable if the stability of the work is to be ensured.

The Engineers explain that the rocks underlying this part of the

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Derwent Valley are of the extensive and well-known Goredale series, consisting of sandstone and shale in layers of varying thickness; the sandstone beds being cracked and broken, allowing of the free passage of water through the joints. The excavation of the heading has been carried to a length of 300 feet eastward into the hill, measuring from the end of the concrete already put in. The rocks for a distance of 250 feet are faulted, crushed, disturbed, fractured, and shattered throughout, and will not turn water; and the whole strata there, so far as opened out, will pass water freely. Faults or throws are very frequently struck; and while they are not of any great height—the disturbances or breakage running from a few inches to 3 ft. 9 in.—it must be remembered that, while faults exist, water will, as a rule, pass. The backs or joints of the sandstone are open, and where partly filled by clay, the clay is found mixed with sand, and is not water-tight. The fact of the heading being dry affords the strongest evidence of its being unable to turn or retain water. The final 50 feet at the last end of the heading shows an improvement; the strata being closer and more regular. The floor of the heading has been tested by impounding water in short lengths between stanks, with the result that it has been made clear that considerable quantities can get away to lower levels. At a distance of between 30 and 40 feet below the level of the heading there is a bed of fairly indurated shale, 8 feet in thickness. It has been observed from time to time that springs of considerable size were issuing above the shale bed, and some are still to be seen in the shaft which has been left at the end of the concrete. The Engineers are therefore of opinion that it would not be desirable to carry the excavation further down than this shale bed. If a trench be sunk into it, they have confidence in saying that a satisfactory foundation will be secured. Their examination, they regret to state, shows that the strata lying above the 8-feet shale bed for 250 feet of the length of the heading will allow water to pass from the reservoir at all heights of the water. It is to be noted that the level of the heading is 12 feet below the bottom of the reservoir. While this was satisfactory evidence that a good foundation for the extension of the wing will be found, there was no surety that the end of the trench, even when extended, will be water-tight. The Engineers add that it is impossible to predict to what extent leakage will take place, if the wing wall be not extended; and though the quantity of compensation water was considerable (until such time as the works are increased by the other instalments), it is necessary that the wall should be extended in order to reduce to as little as possible the amount of prospective leakage. The Engineers advise that the east wing should be carried down and founded in the 8-feet shale bed for the full length of the present heading; they do not advise that the reservoir should be filled before carrying out the work.

The extension of the trench, which is already being carried out, will cost a further £32,000, and it is estimated will take a year to complete. The outlook for the authorities concerned is certainly not promising; and they may count themselves fortunate if the further expenditure, which in this instance is clearly demonstrated to be unavoidable, is limited to the particular works under notice.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

It will be remembered that about six months ago the Kirkcaldy Town Council decided, owing to the opposition of certain of its members, to take a plebiscite of the ratepayers in connection with the proposed expenditure at the gas-works. The suggestion was certainly a curious one, as the public can hardly be expected to know much about such technical matters, and therefore they are not qualified to judge of them. Since this time nothing has been done, and now, on a motion tabled by the Treasurer, and discussed at considerable length by the Councillors, a vote has been taken as to rescinding the previous resolution of the Council. This resulted in twelve voting each way; so that finally the Provost had to give his casting vote, which was against the plebiscite. This leaves the matter with the restriction removed, so that the Gas Committee are free to bring forward any scheme that they see fit. Opinion seems divided as to the removal of the gas-works to a new site, the rearrangement of the present works, or the spending of a sum of £6000 on repairs. The Provost said he was of opinion that the community could give a better opinion than the members of the Council as to the site, but that the Council, advised by their experts, could give a more reliable one on the financial side. Some remarks were made on the rise from 3s. 2d. to 3s. 4d. per 1000 cubic feet, when a proposal was brought forward to rescind the resolution regarding it. This was not agreed to by a large majority, so that the rise in price remains in force.

There have been one or two appeals in the Valuation Appeal Courts against the valuation of gas-works. The Grangemouth Town Council objected to that for their gas-works being fixed at £2011, and claimed deductions for certain tenants' profits, also depreciation on gas cookers and meters. The valuation was reduced by the Court to the extent of 5 per cent. on £640, which equals £32; this being for depreciation on the value of the cookers, at the price shown in the balance-sheet. Another case was that of the Mid and East Calder Gaslight Company, who asked that the valuation of £40 should be reduced to £25. The valuation prepared by the Assessor had been taken on a period of the last five years, whereas the Secretary of the gas-works claimed that a longer period should have been taken. The Company was started in 1896, and the average difference between income and expenditure for 17 years was £36 14s. The Assessor claimed that it would be grotesque and unworkable to take 17 years for an average. His figure was eventually taken and the appeal dismissed. The higher valuation will not tend to the reduction in the price of gas, which, at present, stands at 7s. 1d. per 1000 cubic feet.

Truly there is an epidemic of vertical retort installations in Scotland at the present time. The Bothwell and Uddingston Gas Company are to have a complete installation to deal with 80 tons of coal daily, with coal and coke handling plants, all on the Glover-West system; and

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they have accepted the tender of West's Gas Improvement Company, Limited, for the erection. The Hamilton Town Council Gas Committee are to visit places where the various systems of these retorts are in use, so that they may decide upon the best plant to adopt to enable them to deal properly with the probable increased demand, which, Mr. Ballantyne anticipates, will call for extensions next year. Yet another gas-works is proposing to adopt vertical retorts, and a scheme of extensions, to cost something like £20,000, has been proposed for Rothesay. This has been remitted to a Joint Sub-Committee of the Gas and Finance Committees. Contracts have already been accepted for extensions of the exhauster house and exhauster and pumps at a total cost of £320 3s.; and the scheme not only includes the vertical retorts already referred to, but also an additional gasholder. Ex-Bailie James Macmillan, the Convener of the Gas Committee, said that the consumption last month constituted a record, being 15 per cent. more than during the previous August; so that, to cope with the demand, extensions were absolutely necessary.

The Fraserburgh Town Council have had a successful year's working of the gas-works, having a surplus of £800, which it is proposed should go towards reducing the price of gas during the coming year. The question of summer lighting is one of considerable importance in certain towns, especially in those of the industrial and mining order. Dunfermline is taking steps to provide additional safeguards for the public by doubling the number of lamps that are to be lighted during the summer season. The enormous increase in the population, due to the large number of navvies and other workmen engaged at the Rosyth Naval Base Works renders this precaution necessary.

Another Town Council is proposing to acquire the local gas-works, for it is understood that a resolution as to the adoption of the Burghs Gas Supply (Scotland) Act, 1878, has been made by the Haddington Town Council, and that further meetings are to be held in regard to the matter. Another motion is that a meeting of the Council should be called at an early date to consider an offer by the Gas Company regarding automatic street lighting. This automatic system is extending rapidly, as the Peebles Town Council have also decided upon the recommendation of the Lighting Committee that the pressure-wave system should be adopted in the burgh at a cost of about £700. It is estimated that the saving will amount to about £60 a year. Dunbar is also to expend over £100 on improving the street lighting. The street lighting of a large city amounts to a considerable sum, and people not immediately connected with such work would be surprised at the expenditure. The accounts for Edinburgh show that £44,708 have been expended on the lighting departments, and that the electric lighting revenue exceeds the expenditure by £2169.

Many gas engineers are averse to employing electricity in their works; and if they have the same trouble with it that has been experienced by Mr. Vass at Perth, there will be a further objection to its use. The motor of the pusher of the stoking plant broke down, and on examination it was found that the head of a stud had broken off and badly damaged the armature. The spare armature was put into use, and, on inspection by the insurance company's representative, was pronounced in good order. Within 25 hours of starting the second armature was found defective, and was repaired by a workman from the makers, who replaced or examined all the studs. Mr. Vass reported to the Council that he considered it advisable to have, as a reserve, a complete pusher, which could be used along with the present one and greatly facilitate working in winter time. This will cost £825. At the same time, Mr. Vass recommends strengthening the stage floor, as there is now considerable vibration and deflection on the floor during the travel of the stoking machine.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Sept.* 13.

Sulphate of Ammonia.

Throughout the week the market for this article has continued very firm, although the advance in price has naturally not been so rapid as it was a short time ago. Both home and foreign consumers have been sending more inquiries for near and distant delivery, and now seem to believe that it may prove to be good policy to cover part of their requirements at present values. The quotations at the close are £13 10s. per ton f.o.b. Hull, £13 11s. 3d. per ton f.o.b. Liverpool, and £13 12s. 6d. per ton f.o.b. Leith. The firmness of manufacturers has restricted business in the forward position; but it is reported that £13 15s. per ton has been paid at the best ports for delivery over the first half of next year.

Nitrate of Soda.

This market is still without alteration, and holders repeat quotations at 10s. 9d. per cwt. for ordinary and 11s. for refined quality, on spot.

LONDON, *Sept.* 15.

Tar Products.

There has been little alteration in the markets for tar products during the past week. On the whole, prices remain about the same; but there is not much activity with any articles. Pitch has maintained its price; but there has been very little fresh business doing. Consumers appear to be in no hurry to pay the present prices. Benzol, 90 per cent., is very firm, and good prices are being paid for this year's delivery. The consumption for motor purposes increases almost daily; and this is certainly keeping the price firm. There has been more inquiry also for next year's delivery. Solvent naphtha is still very quiet, and contracts are very difficult to arrange. Heavy naphtha shows no signs of improvement. Creosote is very firm, and business is reported, both for this and next year's delivery, at very good prices. In crude carbolic there is little or no business doing. Very low prices are quoted by consumers—in fact, the majority of them do not appear to be actual buyers at the present moment.

The average values during the week were: Tar, 29s. 3d. to 33s. 3d.

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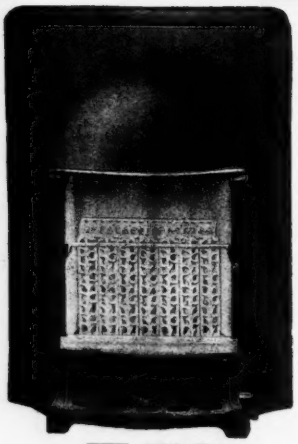

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Pitch, London, 44s. to 45s.; east coast, 44s. 6d. to 45s.; west coast, Manchester, 43s. to 43s. 6d.; Liverpool, 44s. to 44s. 6d.; Clyde, 44s. 6d. to 45s. Benzol, 90 per cent., naked, London, 1s. 1d. to 1s. 1½d.; North, 11½d. to 1s.; 50-90 per cent., naked, London, 1s. to 1s. 0½d.; North, 11d. to 11½d. Toluol, naked, London, 10⅞d. to 11d.; North, 11½d. to 11¾d. Crude naphtha, in bulk, London, 5¼d. to 5½d.; North, 5d. to 5¼d. Solvent naphtha, naked, London, 10¼d. to 10⅝d.; North, 9¾d. to 9⅞d. f.o.b. Heavy naphtha, naked, London, 10d. to 10½d. f.o.b.; North, 9d. to 9½d. f.o.b. Creosote, in bulk, London, 3⅜d. to 3½d.; North, 2⅞d. to 3d. Heavy oils, in bulk, London, 3½d. to 3⅝d. Carbolic acid, casks included, 60 per cent., prompt, east coast, 1s. 3d. to 1s. 3½d.; west coast, 1s. 2½d. to 1s. 3d. Naphthalene, £4 10s. to £10; salts, 50s. to 55s., bags included. Anthracene, "A" quality, 1½d. to 1⅝d. per unit, packages included and delivered.

Sulphate of Ammonia.

Although there has been practically no alteration in the price, the rise appears to have stopped, and sales have again been very difficult to negotiate. Outside London makes are quoted at £12 12s. 6d. to £12 13s. 9d.; Hull, £13 6s. 3d.; Leith, £13 8s. 9d.; Liverpool, £13 7s. 6d.; and Middlesbrough, £13 7s. 6d.

COAL TRADE REPORTS.

Northern Coal Trade.

There is an improved demand for coal, with fuller supplies of tonnage, so the shipments are heavier. In the steam coal trade, the large contracts in the market have given firmness to prices. For best Northumbrians, from 15s. 4d. to 15s. 6d. per ton f.o.b. is quoted, second-class steams are about 13s. 3d., with steam smalls varying from near 8s. to 9s. 6d. Not much coal has yet been locally sold for the Russian demand, which is heavy. In the gas coal trade, the demand increases steadily. For prompt supplies, best Durhams are quoted at from 15s. to 15s. 1½d. per ton f.o.b.; second-class descriptions are rather firmer at about 14s.; and for "Wear Specials" from 15s. 3d. to 15s. 4½d. is the current price. In addition to a steadier coal market, there are higher rates in some cases for coal freights. Forward sales of gas coal are being negotiated for shipment to some of the Mediterranean ports. For early delivery at Genoa, somewhere near 24s. per ton delivered is commonly named, with lower prices for next year's supplies—down to 20s. 6d. being spoken of. The Gothenburg supplies of gas coal are now in close negotiation; but the prices do not seem to be exactly decided. Coke is steady, and gas coke is firmer, with prices from 17s. 3d. to 17s. 9d. per ton f.o.b. in the Tyne for good qualities. At some of the shipping ports the stocks of gas coke have been reduced by exports.

Scotch Coal Trade.

The coal trade throughout Scotland continues to be brisk, both for home and export markets. On Friday, the following were the approximate prices quoted on the Glasgow Coal Exchange: Ell (best brands) 13s. 3d., splint 12s. 9d. to 15s. 9d., navigations 15s. to 16s. 9d., steams 12s. to 13s. 6d., Hartleys 15s., trebles 13s. 9d., doubles 13s., singles 11s. 3d., pearls 10s., and dross 8s. f.o.b. Glasgow.

Gas Explosion at Edgbaston.—Taking a light with the object of locating a gas escape in a private house at Edgbaston, a man and two women were successful in their quest, and the explosion caused burns which necessited medical attention to two of them. There was also a good deal of damage to the room and its contents.

Public Lighting of Frinton-on-Sea.—Tenders for lighting the streets were considered by the Frinton-on-Sea Urban District Council at their last meeting. The Tendring Hundred Water-Works Company offered to light the lamps with gas, at an annual charge of £2 12s. for ordinary lamps, and £6 18s. for a special all-night lamp. The Frinton Electric Light Company's quotation was £2 17s. 6d. and £4 7s. 6d. respectively. Both offers were for a period of seven years. The Council decided to accept the tender for gas, and that a contract for seven years should be entered into.

South Staffordshire Mond Gas Company's New Capital.—A resolution was passed at a meeting last week of the South Staffordshire Mond Gas Company authorizing the issue of £100,000 of preference share capital. These shares are to be entitled to a cumulative preferential dividend of 6 per cent. per annum, and are to be subject to the right of the Company to issue other preference shares ranking *pari passu* with them, until the total issue of such shares shall amount to one-half the capital of the Company. It was pointed out that the necessary Act had been obtained, and that the Directors had also incorporated in it provisions to enable them to start a co-partnership scheme and a benefit scheme for the workmen. These will be brought forward later on. It was further stated that the Company are now supplying gas to well over 140 works.

Street Lighting in Sheffield.—The Directors of the Sheffield United Gaslight Company nominated by the City Council have issued their report upon the street lighting of the city during the year ended Aug. 31. The quality of gas supplied to the city, the report states, has been above the required standard. New extensions have been promptly made as and when necessary, and the whole of the plant and service mains have been well and efficiently maintained. The price of gas for public lamps, which was 11d. per 1000 cubic feet last year, has been further reduced, as from April 1 last, to 10d. per 1000 cubic feet. The improved lighting of Church Street and West Street, the lamps for which were installed at the Company's expense, as a sample of street lighting, and maintained by them at an inclusive price for lighting, extinguishing, and maintenance of £3 6s. per annum, has been satisfactorily continued.

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Waterford Gas Company.

Mr. George Lynch, presiding at the annual meeting of the City of Waterford Gas Company, said the report was a favourable one, and they were able to distribute the fully-earned dividend of 7½ per cent. They had also to report favourably of the success of the profit-sharing scheme initiated four years ago, under which they had already divided £1025 among the men, of whom 40 were now shareholders in the Company, without any cost to themselves. In these days of labour unrest they were looking forward to a continuance of the friendly relations that had so long existed between the Company and their workmen. There was a prospect of electric light being introduced in the city. Some members of the Corporation seemed to think electricity would cause a revival and increase of prosperity; but he had not seen or heard of any such effect following its introduction in other Irish cities. He would remind them that, without competition or solicitation, the Company had been supplying gas at the same prices as were charged in Dublin and Cork. If the electric light were introduced, there might at first be a decrease in sales and a slight reduction in dividends; but the Directors expected that this would be merely temporary. This had been the case in the instances nearest to them —Cork and Queenstown. In face of the most vigorous opposition, the Cork Gas Company had been selling more gas than before the electric light was introduced; and both the Companies named were paying the full dividends, as before. With such examples so close to them, they need have no fear as to the future of the Waterford Company. The report was adopted, and the dividend declared.

Glover-West Verticals for Uddingston.—The Directors of the Bothwell and Uddingston Gas Company, Limited, have accepted the tender of West's Gas Improvement Company for an installation of Glover-West vertical retorts, capable of carbonizing 80 tons per 24 hours, complete with coal and coke handling plant.

Maryborough (Queensland) Gas Company, Limited.—The profits of this Company for the six months ended June 30, after making provision for bad and doubtful debts, repairs and renewals, depreciation, working expenses, wear and tear, and all other charges, including the balance brought forward, amounted to £1061; and after the payment of a dividend of 6 per cent. per annum (free of income-tax), there was a sum of £236 to be carried forward to the next account.

An Assertion and a Correction.—A report reproduced in "Electrical Industries," to the effect that there was considerable dissatisfaction in Nottingham concerning the public gas-lighting arrangements, drew a statement of the real facts of the case from Mr. Frank B. Harris, Clerk of the Peace at Nottingham, with the result that our contemporary has since published a correction. Mr. Harris said: "The town is thoroughly well lighted, at a very large annual expense, with incandescent gas-lights; and the main open spaces are lighted with powerful electric arc lamps. I think that Nottingham, as a whole, may be described as an exceptionally well-lighted town."

Brisbane Gas Company.—A contract has been entered into by the Brisbane Gas Company for the necessary material for an installation of Glover-West vertical retorts. The accounts of the Company for the half year ended June 30 show a net amount to the credit of profit and loss (inclusive of the balance from last half year) of £15,055. A dividend of 6 per cent. has been declared, amounting to £12,480, and £624 has been paid for income-tax, making together £13,104, and leaving £1951 to be carried forward.

Bacup Street Lighting.—At the quarterly meeting of the Bacup Town Council last week, Mr. George Smith said they had received a notification from the Rossendale Gas Company that they were going to reduce the contract price to the Corporation for the lighting of the borough for the next six months by 1d. per 1000 cubic feet. This would make a reduction of about £24 in the amount to be paid. In all probability they would extend the lighting season by continuing later and commencing earlier in future seasons.

Burnley and Water Gas.—It was remarked by Dr. Clegg at a meeting of the Burnley Town Council that there was an impression in the town that a fair amount of sickness was due to the abnormal amount of carbon monoxide in the gas supplied by the Corporation. In the report for the past month, it was stated that there was 14 per cent. of water gas used, and it was suggested that the more there was of this the more carbon monoxide there was. What was the statutory limit to the amount of water gas that could be used, and was 14 per cent. a low proportion? Alderman Emmott (the Chairman of the Gas Committee) replied that little water gas had been used for months. They did not make the gas for people to breathe; and when it was burned, it was not more dangerous than the ordinary coal gas. He considered 14 per cent. was very low. The gas they had been making was as pure as any made in the country. They were not limited by Statute.

Dover Gas Company.—It was stated in the report adopted at the half-yearly meeting of the Dover Gas Company that the profit on the past six months' working was sufficient to provide for the full statutory dividend on the shares and stock; and the Chairman (Mr. Willsher Mannering) said, having regard to the increased cost of coal, the Directors were pleased to have so favourable a statement to present. There had been a decrease of 2·3 per cent. in the consumption during the year ended June last; but the net profit for the half year was within £8 of that of the corresponding half of the previous year. The officers, staff, and workmen had again discharged their respective duties with zeal and efficiency. They were hoping before long to test Kent coal again. They had already done so in a small way; but the coal was unwashed. So far as the tests went, they were fairly satisfactory; and the Board trusted that they might, at no great distance of time, be able to purchase from the Kent collieries. This should effect a very great saving. A vote of thanks to the staff was acknowledged by the Secretary (Mr. E. C. Fielding) and the Resident Engineer (Mr. E. C. Herring).

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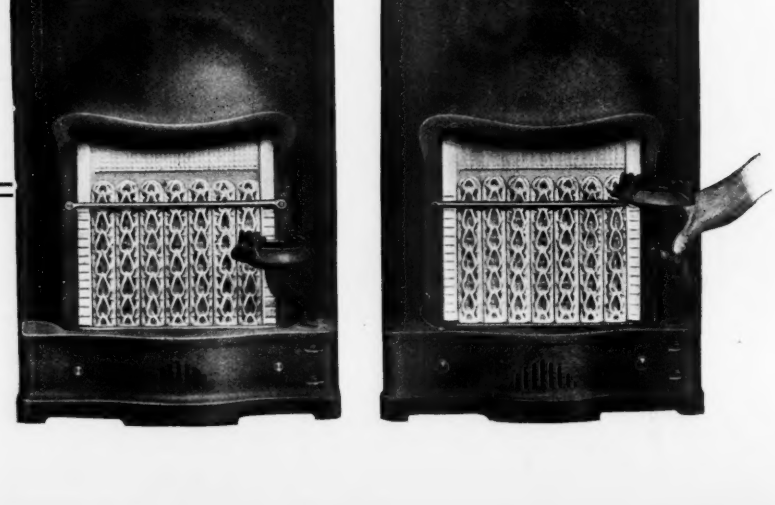

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LONDON.

Meeting Demands at Weston-super-Mare.

The works of the Weston-super-Mare Gas Company being only just equal to the immediate requirements, the Directors, acting under the advice of Sir Corbet Woodall, have decided to remodel and rebuild them. This statement was made by the Chairman (Mr. J. E. Norman, J.P.) at the half-yearly meeting of the Company; and he added that the scheme is going forward in a highly satisfactory manner. The report submitted intimated that in the six months ended June 30 there had been a considerable increase in the sale of gas, as compared with the corresponding period of the previous year. The Directors recommended the payment of the maximum dividend of 5 per cent. per annum (less income tax) on the ordinary stock, and an addition of £700 to the reserve fund and £500 to the insurance fund. Since the last meeting, Mr. T. W. Luckhurst, of Plymouth, has been appointed in the place of the late Secretary. During the past year, fresh capital has been raised; but it will be necessary to issue further stock to meet the cost of the extension and re-building scheme, in connection with which contracts totalling nearly £24,000 have been entered into. Under the co-partnership system, instituted in 1909, 65 of the employees have become stockholders in the Company. In acknowledging a vote of thanks, the Chairman referred to the assistance he had received from Mr. J. H. Gray, the Engineer and Manager.

Doncaster District Water Supply.

Negotiations have been in progress for some time between the Leeds Corporation Water Committee and the Doncaster Corporation for the supply of water by the former to the Doncaster district. An agreement has now been drafted under which the Water Committee, subject to the approval of the City Council, undertake to deliver water in bulk to supplement the present available supply of the Doncaster Corporation. The trunk water-main is to be large enough to deliver at least 2,000,000 gallons per day. The Leeds Corporation are to contribute £2000 towards the expense of extending the intended water-main from the Bodles in such a direction within the Doncaster water area as the Doncaster Corporation may desire; and the latter agree to take a minimum of 500,000 gallons per day, and may exercise the right up to 2,000,000 gallons. If at any future time Doncaster desires to go beyond this quantity, Leeds undertakes to give an aggregate supply up to 4,000,000 gallons after at least seven years' notice has been given. The price fixed for the first 500,000 gallons is 8d. per 1000 gallons, for the second 7½d., for the third 7¼d., and for the fourth 7d. If in future the additional supply is called for, the price will be 6½d. per 1000 gallons. It is understood that the Water Committee have been in negotiation with other authorities in addition to Doncaster; and it is probable that in course of time they will serve with water the Tadcaster district, the Hemsworth district, and the area controlled by the Doncaster Rural District Council. The Doncaster scheme will be discussed at the next meeting of the City Council; and a Bill will be promoted in Parliament.

Water Scarcity at Nelson.—It was reported to the Water Committee of the Nelson Corporation last Wednesday evening that the reservoirs at Ogden contained barely nine days' full supply of water; but as consumers were being supplied during only eight hours a day, the stock would, of course, last longer than the time named. The outlook was being regarded with much anxiety.

Price of Gas for Power at Congleton.—Some difference of opinion being manifested among the members of the Congleton Corporation Gas Committee as to the advisability of increasing the price of gas used for power, the Gas Manager (Mr. J. T. Broughton) was some weeks ago instructed to obtain particulars as to the charges in other boroughs of similar size. He did so, and the information secured came before the Gas Committee last week. The Chairman (Alderman Solly) then said that, as soon as the reports of the previous meeting appeared in the Press, travellers for suction-gas plants were in the town stating that at a charge of 1s. 10d. per 1000 cubic feet they could undersell the gas-works. If they raised the price of gas for manufacturing purposes, they would lose custom; and he therefore proposed that the rate be not advanced. Mr. Lawton said they raised the price of coke because the cost of coal went up; and he thought it quite as fair to raise the price of gas for power. The Chairman pointed out that the price of coke was raised because people were willing to pay more; and it was decided to leave at its present figure the charge for gas used for power purposes.

Complaints are being made at Crowle, in Lincolnshire, as to the charges for the supply of gas. The prices at present in operation are from 4s. 7d. to 4s. 9d. per 1000 cubic feet; and it is contended that these are too high. At the last meeting of the Crowle Council, the matter was discussed; but though it was felt that the charges were excessive, no definite action was decided upon to obtain a reduction.

The Knaresborough Gas Committee have taken the initiative in the provision of an electric lighting scheme for the town. The Committee recommended the placing of a turbine by the side of the River Nidd, for the purpose of supplying electric light; pointing out that the experience of other towns has shown that, with the increasing use of gas for cooking and other purposes, the provision of electricity for lighting has had no detrimental effect upon the gas consumption, and that, if the Council did not quickly make a move, some private company would probably do so. The Council have adopted the recommendation.

The Rutherglen Town Council have decided to instal the "A. & M." patent lighting and extinguishing apparatus upon the whole of their street-lamps, to the number of about 650. The installation will be operated from the Dalmarnock Gas-Works of the Glasgow Corporation. The Peebles Town Council have also decided to instal similar apparatus, together with the Alder and Mackay hurricane-proof lantern, to the number of 272. As a means of obtaining the extra pressure required to operate the system, the Town Council will put down a boosting plant at the gas-works; and this work will be carried out by the Bryan-Donkin Company, of Chesterfield.

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By the fusing of an electric wire, an outbreak of fire took place on the 6th inst. in the foundry departments of the Hallside works of the Steel Company of Scotland at Cambuslang.

The Manchester Municipal School of Technology (the Principal of which is Mr. J. C. Maxwell Garnett, M.A.) forward a prospectus of their part-time courses, for the session 1913-14. These courses, which extend over a period of five years, include gas manufacture—a subject which the syllabus shows to be very fully dealt with. The conditions of admission to the classes, fees, &c., are set forth in the prospectus.

The Rochdale Gas Committee had under consideration at their last meeting tenders for the supply of oil in connection with the carburetted water-gas plant. It was stated that, owing to the high price of this commodity, no water gas had been manufactured at the works for some time; but it was felt by the Committee that a stock of oil should be procured, in order that the department may be prepared for any emergency. A tender was accepted for 500 tons. The price to be paid represents an advance of about £1000 on that paid for a similar quantity about a couple of years ago.

The New Inverted Incandescent Gas-Lamp Company, Limited, have issued their catalogue for the season 1913-14. As compared with the previous edition, the pages have increased from 136 to 166, which shows the expansion of the wares of the Company. Any form of inverted burner for any purpose that may be required will be found here in various styles; fittings and glassware are there; and all the accessories required in lighting—down to small connections—are seen. There is great rivalry now among lamp and lighting fittings makers to bring out both useful and attractive lighting catalogues. The New Inverted Company take great pride in the illustrations and printing of their catalogue; and we congratulate them on both. It is a good production; and they deserve all praise for it.

Mr. Julius Bradbury has joined the firm of Thrutchley and Co., Limited, as a salesman in their gas coal department. For several years Mr. Bradbury has been identified specially with the gas coal trade, in which he has had long experience—formerly as a colliery commercial manager in Yorkshire (Barnsley district) and of recent years as a representative in London and Manchester of gas coal firms.

At the instigation of Mr. W. Chew, the Deputy Gas Engineer, the outdoor staff of the Blackpool Corporation gas department are in future to be technically trained; arrangements being now in progress for the formation of a class in "Gas Supply," under the auspices of the City and Guilds of London Institute. It is hoped, also, to enrol local plumbers' apprentices, who will be enabled to obtain certificates of proficiency in this branch of their trade. The scheme, it is claimed, will be of benefit to householders, who will thereby be enabled to rely upon having expert advice free as to gas appliances and their use, when visited by gas officials.

The York Gas Company have lately put down a new main to Haxby; and with the view of helping the residents to avail themselves of the commodity it will convey to them, an exhibition of gas appliances, promoted by the Company in conjunction with Messrs. John Wright and Co., was opened on the 1st inst. by Mr. Arthur Wood, the Chairman of the Parish Council, in the presence of a large majority of the inhabitants of the village. The exhibition was held in a large marquee, the interior of which had been tastefully arranged and was brilliantly illuminated by gas. It also contained a particularly good selection of gas-fittings. Lectures on cooking were given by Mrs. Middleton every afternoon and evening during the week. The Company's new Engineer and Manager (Mr. H. E. Bloor, B.Sc.) was in attendance at the opening of the exhibition, and assured the villagers that the Directors and management would have great pleasure in complying with any requests made to them.

GAS COMPANIES' STOCK AND SHARE LIST.

There was no speeding-up of business on the Stock Exchange last week—indeed, it being account week, and the settlement largely engrossing attention, fresh business was quite as scarce as ever. Happily the adjustment of the account was not a difficult affair. There was no perturbing factor of a magnitude to upset markets, except apprehension regarding labour troubles; the foreign elements of discord in the Balkans and China and Mexico seeming to have lulled for awhile. On the opening day, the settlement in the Mining Market was the chief item. As for other departments, quiet is hardly the word—stagnation would be nearer the mark. Powerless to resist a little selling, they gave way, and prices fell. Gilt-edged were quite flat, and Consols lost $\frac{5}{16}$. Only Americans showed any backbone. On Tuesday, the general tendency was dull from inactivity; but Government issues were stronger, and Consols recovered their loss. Rails were weaker throughout the list. Wednesday produced a nice change of tone, and, encouraged by one or two factors, markets in general became more cheerful. Gilt-edged were firm, Consols rose $\frac{1}{16}$, Rails profited by good traffics, which, with existing low prices, tempted buyers into the market, and Americans had quite a bright day. On Thursday, the settlement was satisfactorily completed, and the tone was fair on the whole, though one or two weak spots showed out here and there; Consols losing $\frac{1}{16}$. Rails were firm with rising figures, and Americans added to their gains. Friday was very quiet, and markets for the most part were dullish. Little was done in Government issues, and Consols were inclined to ease. Rails were lethargic and prices irregular. American and Canadian, however, were active and buoyant. Saturday was, as usual, very quiet and without any marked movement. Consols closed at $73\frac{3}{8}$ to $73\frac{5}{8}$—showing no change in the week. In the Money Market, rates remained very steady, and closed firm. Business in the Gas Market showed some signs of an approaching return to activity, and transactions were fairly well distributed. Changes in quotation were neither numerous nor considerable in extent; but they were all in the upward direction. In Gaslight and Coke issues, the ordinary was tolerably busy, and prices looked like hardening; all transactions being within the limits of $101\frac{5}{8}$ and $102\frac{1}{2}$. In the secured issues, the maximum made $76\frac{1}{4}$ and $76\frac{1}{2}$, the preference $94\frac{1}{2}$ to 96, and the debenture $73\frac{1}{2}$ to 74. South Metropolitan was quiet and unchanged at 110 to 111. In Commercials, the 4 per cent. realized $105\frac{1}{2}$ and $106\frac{1}{2}$, the $3\frac{1}{2}$ per cent. $103\frac{1}{4}$, and the debentures $72\frac{1}{4}$—a rise of $\frac{1}{2}$. Among the Suburban and Provincial group, British was done at $45\frac{3}{8}$ and $45\frac{1}{2}$, Ilford "B" at $119\frac{1}{4}$ *ex div.*, South Suburban at 116 (a rise of $\frac{1}{2}$), and, on the local Exchange, Newcastle at par. In the Continental Companies, Imperial was marked at 164 to 165, ditto debenture at $84\frac{1}{2}$, Union at $81\frac{1}{4}$, European at $18\frac{3}{8}$ to $18\frac{1}{2}$, and Tuscan debentures at $96\frac{1}{2}$ and 97—a rise of 2. Among the undertakings of the remoter world, Monte Video changed hands at $12\frac{1}{4}$ and $12\frac{3}{8}$, Oriental at $125\frac{1}{2}$ and 126, Primitiva at $6\frac{1}{8}$ and $6\frac{5}{16}$, and ditto preference at 5.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.	Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.	£			p.c.				£ s. d.
1,551,868	Stk.	April 11	6	Alliance & Dublin Ord.	63–68	..	7 7 1	75,000	5	June 13	6	Malta & Mediterranean	$4\frac{3}{8}$–$4\frac{7}{8}$	..	6 3 1
374,000	,,	July 11	4	Do. 4 p.c. Deb.	80–83	..	4 16 5	250,000	100	April 1	$4\frac{1}{2}$	Met. of Melbourne 4½ p.c. Deb.	98–100	..	4 10 0
280,000	5	April 11	$7\frac{1}{2}$	Bombay, Ltd.	$6\frac{1}{4}$–$6\frac{3}{4}$	..	5 11 1								
50,000	10	Aug. 28	15	Bourne-mouth Gas & Water 10 p.c. Pref. 6 p.c.	28–29	..	5 3 5	541,920	20	May 30	4	Monte Video, Ltd.	$12\frac{1}{4}$–$12\frac{3}{4}$	..	6 5 6
347,500	10	,,	7		$14\frac{3}{8}$–$15\frac{1}{4}$	..	4 11 10	1,775,892	Stk.	July 30	$4\frac{1}{2}$	Newc'tle&G'tesh'd Con.	$99\frac{1}{2}$–$100\frac{1}{2}$	..	4 9 7
75,000	10	,,	6		$13\frac{1}{2}$–$13\frac{3}{4}$	..	4 7 3	529,705	Stk.	June 27	$3\frac{1}{2}$	Do. 3½ p.c. Deb.	$83\frac{1}{2}$–$84\frac{1}{2}$	..	4 2 10
380,000	Stk.	Aug. 14	14	Brentford Consolidated	259–264	..	5 6 1	55,940	10	Aug. 28	7/10/6	North Middlesex 7 p.c.	$12\frac{1}{2}$–$13\frac{5}{8}$	..	5 11 5
380,000	,,	,,	11	Do. New	196–201	..	5 9 5	300,000	Stk.	May 16	8	Oriental, Ltd.	124–129	..	6 4 0
50,000	,,	,,	5	Do. 5 p.c. Pref.	111–113	..	4 8 6	60,000	5	Mar. 28	10	Ottoman, Ltd.	$\frac{1}{4}$–$\frac{3}{4}$	..	5 14 3
206,250	,,	June 13	4	Do. 4 p.c. Deb.	94–96	..	4 3 4	60,000	50	Aug. 14	13	Portsea, Island B	122–125	..	5 6 1
217,380	Stk.	Aug. 28	11	Brighton & Hove Orig.	201–206	..	5 6 10	100,000	50	,,	12	Do. C	119–122	..	4 18 4
244,200	,,	,,	8	Do. A Ord. Stk.	148–151	..	5 6 0	249,980	5	May 16	8	Primitiva Ord.	6–6½	..	6 3 1
630,000	20	Mar. 28	$12\frac{1}{2}$	British	45–46	..	5 8 8	499,960	5	June 27	5	,, 5 p.c. Pref.	5–5½	..	4 15 3
120,000	Stk.	June 27	4	Do. 4 p.c. Deb. Stk.	87–89	..	4 9 11	521,600	100	June 2	4	,, 4 p.c. Deb.	93–95	..	4 4 3
245,771	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	$83\frac{1}{2}$–$91\frac{1}{2}$	..	4 7 5	346,198	Stk.	June 27	4	River Plate 4 p.c. Deb.	90–92	..	4 7 0
100,000	10	—	—	Cape Town & Dis., Ltd.	2–3	..	—	275,000	5	Apl. 11	12	San Paulo, Ltd.	—	..	—
160,000	10	—	—	Do. 4½ p.c. Pref.	4–5	..	—	150,000	10	,,	6	Do. 6 p.c. Pref.	$11\frac{1}{4}$–$11\frac{3}{4}$	..	5 2 2
100,000	Stk.	June 27	$4\frac{1}{2}$	Do. 4½ p.c. Deb. Stk.	75–80	..	5 12 6	125,000	50	July 1	5	Do. 5 p.c. Deb.	48–50	..	5 0 0
157,150	Stk.	Aug. 14	5	Chester 5 p.c. Ord.	107–109	..	4 11 9	135,000	Stk.	Aug. 28	10	Sheffield A	220–222	..	4 10 1
1,513,280	Stk.	Aug. 28	5/9/4	Commercial 4 p.c. Stk.	105–107	..	5 2 1	209,984	,,	,,	10	Do. B	220–222	..	4 10 1
560,000	,,	,,	$5\frac{1}{2}$	Do. 3½ p.c. do.	102–104	..	5 2 6	523,500	,,	,,	10	Do. C	220–222	..	4 10 1
475,000	,,	June 13	3	Do. 3 p.c. Deb. Stk.	$71\frac{1}{2}$–$73\frac{1}{2}$	$+\frac{1}{2}$	4 1 8	90,000	10	May 30	$7\frac{1}{2}$	South African	$9\frac{1}{2}$–$10\frac{1}{2}$	..	7 2 10
800,000	Stk.	,,	4	Continental Union, Ltd.	80–83	..	4 16 5	6,429,895	Stk.	Aug. 14	5/9/4	South Met., 4 p.c. Ord.	109–111	..	4 18 6
200,000	,,	,,	7	Do. 7 p.c. Pref.	124–126	..	5 11 1	1,895,445	,,	July 11	3	Do. 3 p.c. Deb.	73–75	..	4 0 0
492,270	Stk.	—	5	Derby Con. Stk.	123–124	..	4 0 8	209,820	Stk.	Aug. 14	$8\frac{1}{2}$	South Shields Con. Stk.	157–159	..	5 6 11
55,000	,,	—	4	Do. Deb. Stk.	102–104	..	3 16 11	952,795	Stk.	,,	6	S'th Suburb'n Ord. 5 p.c.	$114\frac{1}{2}$–$116\frac{1}{2}$	$+\frac{1}{2}$	5 3 0
1,002,180	10	July 30	10	European, Ltd.	$17\frac{1}{2}$–$18\frac{1}{2}$	..	5 8 1	60,000	,,	,,	5	Do. 5 p.c. Pref.	113–115	..	4 6 11
16,386,660	Stk.	Aug. 14	4/17/4	Gas-light and Coke 4 p.c. Ord.	101–103	..	4 14 6	117,058	,,	June 27	5	Do. 5 p.c. Deb. Stk.	115–117	..	4 5 6
2,600,000	,,	,,	$3\frac{1}{2}$	3½ p.c. max.	74–77	..	4 10 11	594,740	Stk.	May 16	5	Southampton Ord.	102–105	..	4 15 3
4,062,235	,,	,,	4	and 4 p.c. Con. Pref.	93–96	..	4 3 4	120,000	Stk.	Aug. 14	$7\frac{3}{8}$	Tottenham and Edmonton A 5 p.c.	136–139	..	5 6 1
4,674,850	,,	June 13	3	Coke 3 p.c. Con. Deb.	73–75	..	4 0 0	543,940	,,	,,	$5\frac{3}{8}$	B 3½ p.c.	113–115	..	5 2 2
258,740	Stk.	Sept. 11	5	Hastings & St. L. 3½ p.c.	87–89*	$+\frac{1}{2}$	5 12 4	149,470	,,	June 27	4	4 p.c. Deb.	90–92	..	4 7 0
82,500	,,	,,	$6\frac{1}{2}$	Do. do. 5 p.c.	—	..	—	182,380	10	,,	5	Tuscan, Ltd.	5–6	..	8 6 8
70,000	10	April 25	11	Hongkong & China, Ltd.	$17\frac{1}{2}$–$17\frac{3}{4}$	..	6 3 11	149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	96–98	+2	5 2 0
131,000	Stk.	Sept. 11	$7\frac{5}{8}$	Ilford A and C	150–153*	$+1\frac{1}{2}$	4 19 8	286,476	Stk.	Aug. 14	5	Tynemouth, 5 p.c. max.	111–113	..	4 8 6
65,780	,,	,,	$6\frac{1}{8}$	Do. B	118–120*	$+1$	5 2 1					Wandsworth, Wimbledon, and Epsom—			
65,500	,,	June 27	4	Do. 4 p.c. Deb.	89–91	..	4 7 11								
4,940,000	Stk.	May 16	9	Imperial Continental	162–167	..	5 7 9	30,000	Stk.	Aug. 28	$8\frac{1}{2}$	Wandsworth A 5 p.c.	155–160	..	5 4 8
1,235,000	Stk.	Aug. 14	$3\frac{1}{2}$	Do. 3½ p.c. Deb. Red.	83–85	..	4 2 4	255,636	,,	,,	$6\frac{1}{2}$	,, B 3½ p.c.	129–134	..	5 2 7
200,242	Stk.	Aug. 28	$6\frac{1}{2}$	Lea Bridge Ord. 5 p.c.	118–121	..	5 3 4	108,075	,,	,,	5/17/8	,, C 3½ p.c.	110–115	..	5 2 0
561,000	Stk.	,,	10	Liverpool United A	204–206	..	4 17 1	352,000	,,	,,	$6\frac{1}{2}$	Wimbledon 5 p.c.	107–112	..	5 8 0
718,100	,,	,,	7	Do. B	142–144	$+\frac{1}{2}$	4 17 3	98,000	,,	,,	$6\frac{3}{4}$	Epsom 5 p.c.	114–119	..	5 11 4
306,083	,,	June 27	4	Do. Deb. Stk.	96–98	..	4 1 8	88,416	,,	June 27	3	3 p.c. Deb. Stk.	68–70	..	4 5 9
63,480	Stk.	June 27	3	Maidstone 3 p.c. Deb.	$66\frac{1}{4}$–$68\frac{1}{2}$	..	4 7 7								

Prices marked * are "Ex-Div."